The RUBBER AGE

March, 1947

LATEX and DISPERSIONS

Thicken less and
cure FASTER at
LOWER temperature with

SETSIT-5

EFFECTIVE
in NATURAL RUBBER
GR-S; GR-M and DISPERSIONS

R. T. VANDERBILT CO., Inc.

230 Park Avenue, New York 17, N. Y.

For Processing Safety...

USE THIONEX ACCELERATOR

TEST DATA

THIONEX ACCELERATED STOCKS

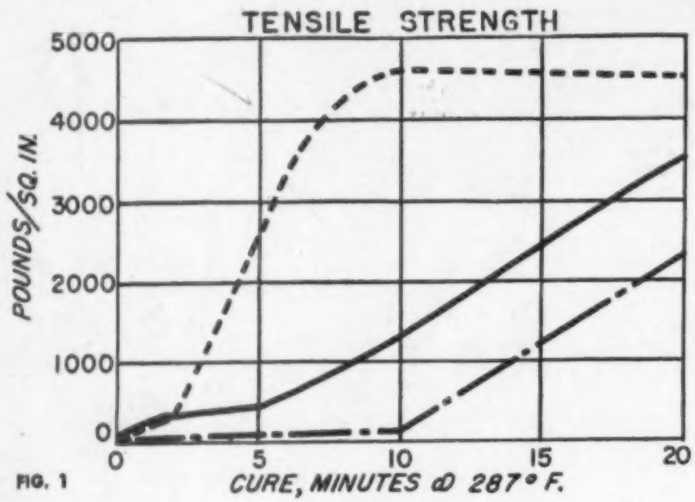


FIG. 1

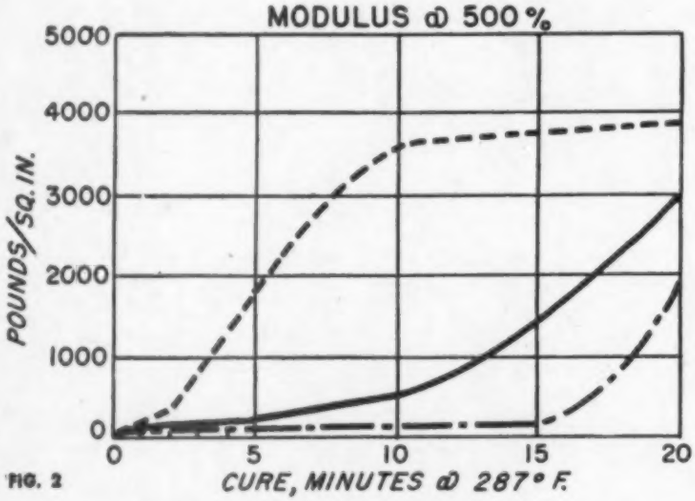


FIG. 2

NATURAL RUBBER - - - - - -
50-50 MIXTURE GRS & NAT. RUBBER ——
GRS — - — - — - —

Delayed Action at Curing Temperature Emphasizes Its Advantage In Rubber and GR-S Stocks

Thionex offers important advantages as an accelerator for natural rubber, GR-S and mixtures of these elastomers.

Outstanding property of Thionex is delayed acceleration . . . a timed action that starts only when the temperature of the stock reaches curing range. Test results show that on specimens cured at 287°F., Thionex does not begin to activate the cure for several minutes. But when the test pieces have been heated long enough to reach curing temperature, rate of cure is rapidly accelerated. These properties—delayed action and fast rate of cure—are graphically shown in Figures 1 and 2.

The delayed action of Thionex emphasizes its processing safety. Compounds may be exposed to temperatures approaching the curing range for short periods of time without danger of setting up during milling, calendering or extruding. And in the production of complicated molded goods, stocks accelerated with Thionex flow evenly—completely fill all sections of the mold before vulcanization begins.

That is why manufacturers have found Thionex so valuable in the production of wire insulation, molded goods, drug sundries, hose, heels and soles, tires and many other rubber products. Write us for detailed information on the use of Thionex in your products.

TABLE 1
Composition of stocks used in preparing test data

Stock No. 1527—	10	11	B12
Smoked Sheets	100.0	50.0	
GR-S		50.0	100.0
Zinc Oxide	5.0	5.0	5.0
Stearic Acid	1.0	1.0	1.0
Sulfur	2.0	2.0	2.0
EPC Carbon Black	50.0	50.0	50.0
THIONEX	0.3	0.35	0.4

DU PONT RUBBER CHEMICALS

E. I. du Pont de Nemours & Co., (Inc.), Wilmington 98, Del.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

DU PONT

THE RUBBER AGE, published monthly by The Palmerton Publishing Co., Inc., Printing Office, East Stroudsburg, Pa. Editorial and Advertising Offices at 250 West 57th Street, New York 19, N. Y. Entered as second class matter October 20, 1933, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Subscription in United States, $3.00 a year; Canada, $3.50; Foreign, $4.00. March, 1947. Vol. 60, No. 6.

SUPERIOR ABRASION RESISTANCE

Parts made from HYCAR synthetic rubber have 50% greater abrasion resistance than parts made from natural rubber. That means they'll last longer, give more dependable performance in the most severe service, and save maintenance and replacement time.

But that's only one of HYCAR's unusual and valuable properties. Examine the list in the box at the right. Think of these properties in terms of your requirements of rubber parts. Realize that these properties may be had in an almost limitless number of combinations, each designed to meet the specific service conditions of the finished part.

We have developed more than 5000 recipes for HYCAR compounds — each compound engineered to do a certain job. If you're looking for rubber parts that will give long life, dependability, and economical operation, *specify HYCAR.*

Ask your supplier for parts made from HYCAR. Test them in your own applications, difficult or routine. You'll learn for yourself that it's wise to use HYCAR for long-time, dependable performance. For more information, please write Department HB-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

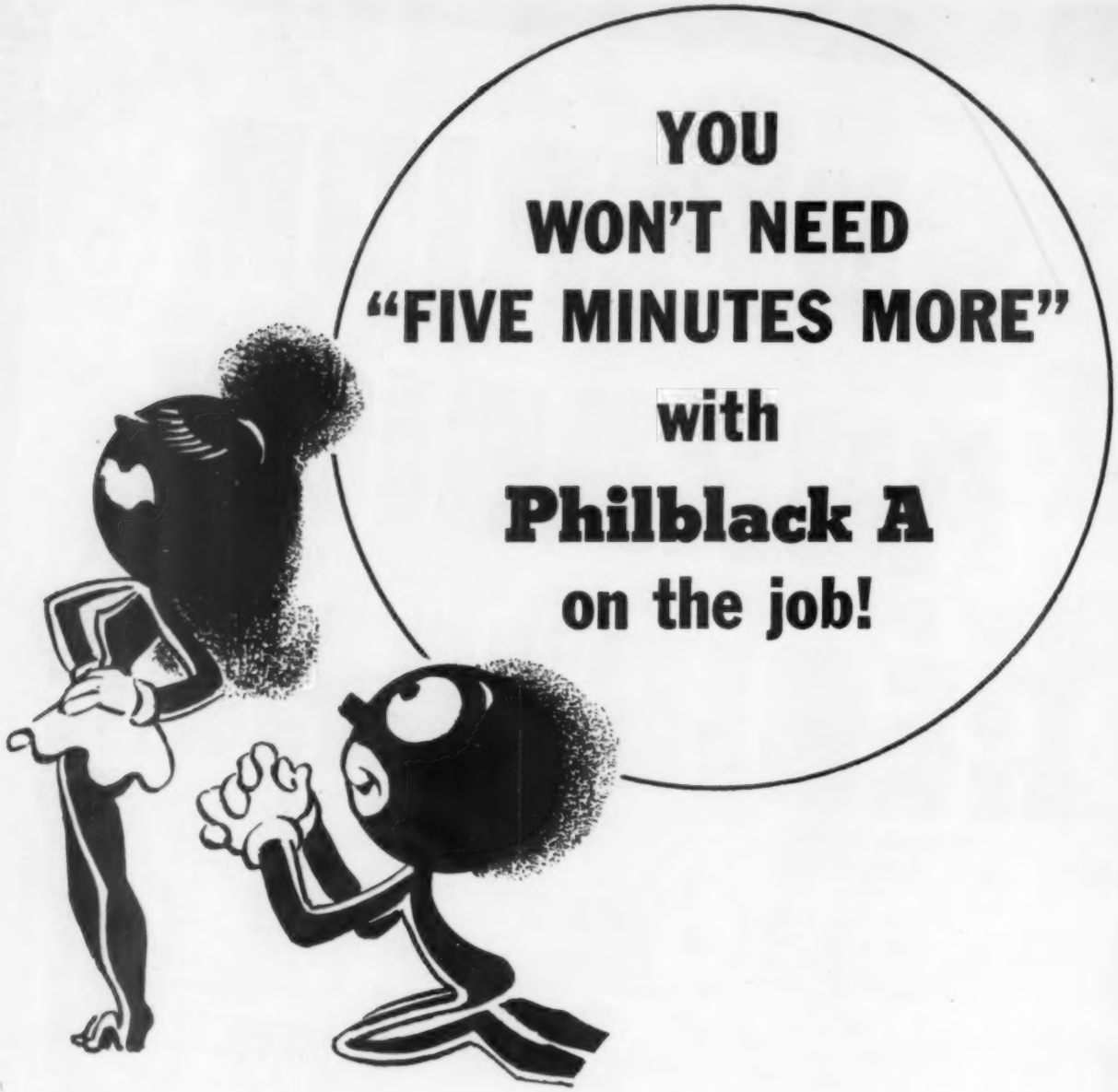
CHECK THESE SUPERIOR FEATURES OF HYCAR

1. **EXTREME OIL RESISTANCE** — insuring dimensional stability of parts.
2. **HIGH TEMPERATURE RESISTANCE**—up to 250° F. dry heat; up to 300° F. hot oil.
3. **ABRASION RESISTANCE**—50% greater than natural rubber.
4. **MINIMUM COLD FLOW**—even at elevated temperatures.
5. **LOW TEMPERATURE FLEXIBILITY**—down to —65° F.
6. **LIGHT WEIGHT**—15% to 25% lighter than many other synthetic rubbers.
7. **AGE RESISTANCE**—exceptionally resistant to checking or cracking from oxidation.
8. **HARDNESS RANGE**—compounds can be varied from extremely soft to bone hard.
9. **NON-ADHERENT TO METAL**—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)

Hycar
Reg. U.S. Pat. Off.
American Rubber

B. F. Goodrich Chemical Company
A DIVISION OF THE B. F. GOODRICH COMPANY

This advertisement appeared in a long list of carefully selected business papers TO HELP YOU SELL *parts made from* HYCAR.



SAVING in processing time is only one of Philblack A's many charms. You can also have products of extremely high quality with lower compound costs.

Road tests indicate that with loadings approximately twenty per cent higher than normally used with EPC, you can obtain comparable tread wear—plus exceptional tire life. Used in the carcass, Philblack A gives you low heat build-up—high heat conductivity and strength at elevated temperatures.

Try out Philblack A as suggested. We are confident you will be more than pleased with the results!

PHILLIPS PETROLEUM COMPANY

Philblack Division

EVANS SAVINGS AND LOAN BUILDING · AKRON 8, OHIO

Traffic paint protectors designed, patented and manufactured by Plastic Engineering, Inc.

Now they're making highway markers from GEON

Another interesting application for GEON raw materials

THOSE highway markers—more properly known as "traffic paint protectors"—are lightweight, easy to handle. They're permanently colored, unaffected by sun, rain, air, heat, cold, paint, oil, or any one of hundreds of normally destructive factors. They're sufficiently resilient that they won't break when dropped from truck to painted line. Nor will they harm a tire if accidentally struck by a car. It was possible to mold them from one of the GEON polyvinyl materials in such a way that they stack easily, yet always land in the right position when dropped from the paint truck.

These properties, plus many others, have made versatile GEON the ideal material for literally hundreds of products in the home and in industry—shower curtains and fly swatters—upholstery and floor tiles—clothing and luggage—wire insulation and acid tank linings.

And GEON can be pressure or injection molded, extruded, calendered or cast into sheet or film. In solution or latex forms it can be applied as coatings for fabrics and fibres of all kinds as well as for paper and cardboard. Products made from GEON may be flexible or rigid, clear or opaque, brilliantly or delicately colored.

For more information about GEON, please write Dept. R-3, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company

A DIVISION OF THE B. F. GOODRICH COMPANY

For technical data please write Dept. CB-3

B. F. Goodrich Chemical Company

A DIVISION OF
THE B. F. GOODRICH COMPANY

ROSE BUILDING, CLEVELAND 15, OHIO

GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE chemicals

★ *A smooth, stable,* **DUSTLESS** *dispersion of* **ZINC STEARATE** *in water in concentrated form*

AQUAZINC

NO DUST . . . HEALTH INSURANCE FOR YOUR PERSONNEL

ATTENTION, manufacturers of milled stock, rubber compounds, molded goods, coated fabric and paper, Butyl rubber, latex and cements. Aquazinc is economical and efficient to use. It can be applied with uniformity and with no loss. It eliminates dust, inconvenience, fire hazard, and other difficulties accompanying the use of powdered Zinc Stearate.

AQUAZINC is particularly convenient for surface application of Zinc Stearate. When diluted with 8 to 20 parts of water, it can be applied by spray or bath.

THE BEACON COMPANY

PURITY · UNIFORMITY · DEPENDABILITY

Chemical Manufacturers

97 BICKFORD STREET · BOSTON, MASSACHUSETTS

In Canada: PRESCOTT & CO., REG'D., 774 ST. PAUL ST. W., MONTREAL

Serving the Rubber Industry for 25 Years

During this time, Climco Processed Liners have been used by hundreds of rubber processors all over the world to achieve better production at lower cost. Their satisfaction and repeat orders account for Cleveland Liner's recognized leadership in the field of liner processing.

We appreciate the patronage received over the years, and pledge continuance of the quality standards that have distinguished our products for a quarter century.

Manufacturers of

CLIMCO PROCESSED LINERS • LINERETTE INTERLEAVING PAPER

THE CLEVELAND LINER & MFG. CO.

5508 Maurice Avenue • Cleveland 4, Ohio, U. S. A.

Cable Address: "BLUELINER"

THE same qualities that made **PLIOLITE S-1** and **S-2** so outstandingly successful are now combined to give you the greatest reinforcing agent of them all—**PLIOLITE S-6.**

Especially compounded for use in reinforcing synthetic rubbers, this light-gravity, non-discoloring agent excels on three important counts:

1. It provides more uniform, more easily handled compounds because it acts as a plasticizer at processing temperatures.

2. Its reinforcement is positive—coupling extra hardness with negligible loss in elongation. Often elongation is increased.

3. Its thermoplasticity makes it a very useful processing aid for smooth extrusions and molded products.

You will find **PLIOLITE S-6** to be highly satisfactory for all compounds needing a light-color, low-gravity stock of 70-90 durometer hardness with good processing characteristics and moldability. It is effective with GRS, Neoprene, Buna N and natural rubber. Available as a powder for your own mixing, or in master batches in whatever synthetic you select. For complete information and sample, write: Goodyear, Chemical Products Division, Plastics and Coatings Dept., Akron 16, Ohio.

Pliolite—T.M. The Goodyear Tire & Rubber Company

GOODYEAR

THE GREATEST NAME IN RUBBER

PELLETEX for TIRES

Today, more than ever, PELLETEX S R F Black is a vital ingredient in tire compounds. Always important because of its low heat build-up in inner tread, shock ply, side walls and bead insulation, heavy loadings of PELLETEX can be used safely *in the outside tread* also.

Present conditions lend emphasis to the suggestion that you "go PELLETEX" throughout in all your tire compounds — both natural and synthetic.

MANUFACTURER
GENERAL ATLAS CARBON CO.
PELLETEX
PAMPA, TEXAS
GUYMON, OKLA.

DISTRIBUTOR
HERRON BROS. and MEYER
NEW YORK, N. Y.
AKRON, OHIO

DISPERSITES FOR TIRE CORD

TRY THIS TEST

The outstanding features of these new Dispersites are their greatly improved cleanliness and ease of handling combined with very high cord adhesion.

Compare! Compound one of these improved Dispersites so that it is ready to use and observe the sedimentation when it is placed in a graduated cylinder for a period of time. Then—make the same test with the dipping bath you are using.

Such a comparison will show clearly that these new Dispersites are cleaner than ordinary tire dips.

Freedom from excess sedimentation and dirt insures better production. Fewer shutdowns are required for equipment cleaning. Investigate!

NAUGATUCK CHEMICAL

Division of United States Rubber Company

NAUGATUCK, CONNECTICUT

BRANCHES: AKRON • BOSTON • DETROIT • LOS ANGELES • NEW YORK

AUTOMATIC
STOCK BLENDER
ATTACHMENT FOR MILLS

REDUCE TEMPERATURE FASTER

Cooler stocks will permit the addition of accelerators without scorching.

Eliminate the human element and increase the uniformity of batches.

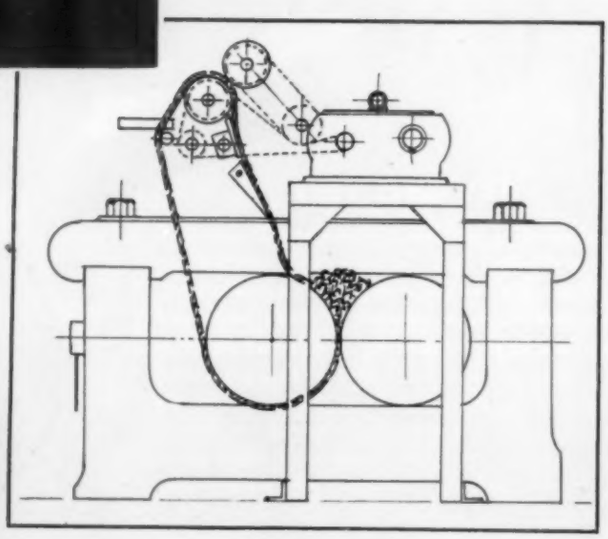
REDUCE LABOR

Eliminate the tiresome labor of hand blending and warm-up. One operator can sometimes operate two or three mills.

INCREASE DISPERSION AND PLASTICITY

The ultimate in dispersion is quickly obtained.

Plasticity speed increased with less heat.

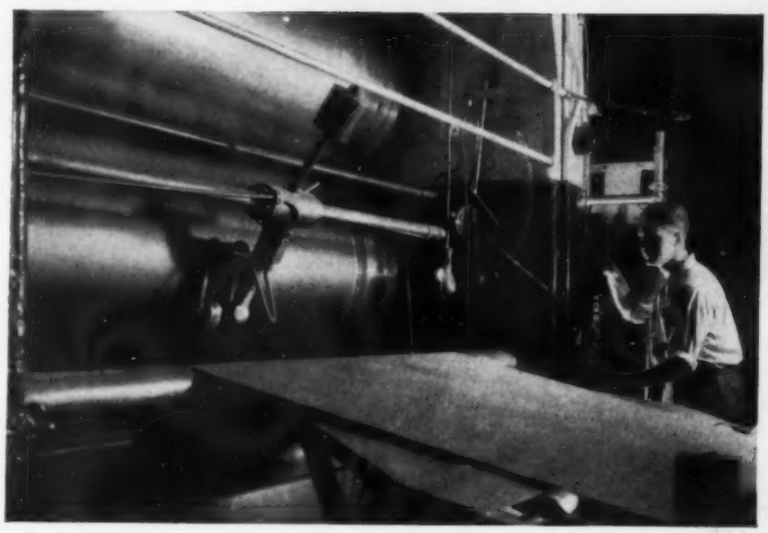


The Akron Standard Mold Co.
Akron — "The Established Measure of Value" — Ohio

BUTAPRENE NAA

BY Firestone

GIVES BETTER FRICTION *and* SKIM COATING



BUTAPRENE NAA accomplishes three factors of importance to you —one, high oil resistance; two, ease of processing; three, fabric protection.

Our Butaprene technical staff will be glad to work with you in solving any problem regarding the use of Butaprene *N* elastomers in either latex or solid form. Write or wire XYLOS RUBBER COMPANY, Distributors, Akron 1, Ohio.

Listen to the Voice of Firestone every Monday evening over NBC

Suggested FORMULAS...

R-9656-E
Butaprene NAA Friction Stock

Butaprene NAA	100
Zinc Oxide	5
Benzothiazyl Disulfide	1
DOTG	.5
Sulfur	2
Dibutyl Phthalate	15
Pine Tar	15
Stearic Acid	1
SRF Black	30
EPC Black	30
Rosin	15
	214.5

R-9654-A
Butaprene NAA Friction and Skim Stock

Butaprene NAA	100
Precipitated Whiting	125
Antioxidant	5
Zinc Oxide	5
Tetrone A	1.25
Santocure	1.25
	237.50

5 BUTAPRENE N POLYMERS TO MEET YOUR SPECIAL NEEDS!

Copyright, 1947, The Firestone Tire & Rubber Co.

Which?

. . . the Chicken or the Egg?

We'd prefer to "pass" on this question—but when it comes to scrap rubber, there are no questions or problems for which we can't provide a quick, intelligent answer based on experience, skill and efficiency.

Progressive Leadership for over 40 years

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122 EAST 42nd STREET, NEW YORK 17, N. Y.

BRANCH OFFICES: New York • Akron • Chicago • Boston • Los Angeles • Memphis

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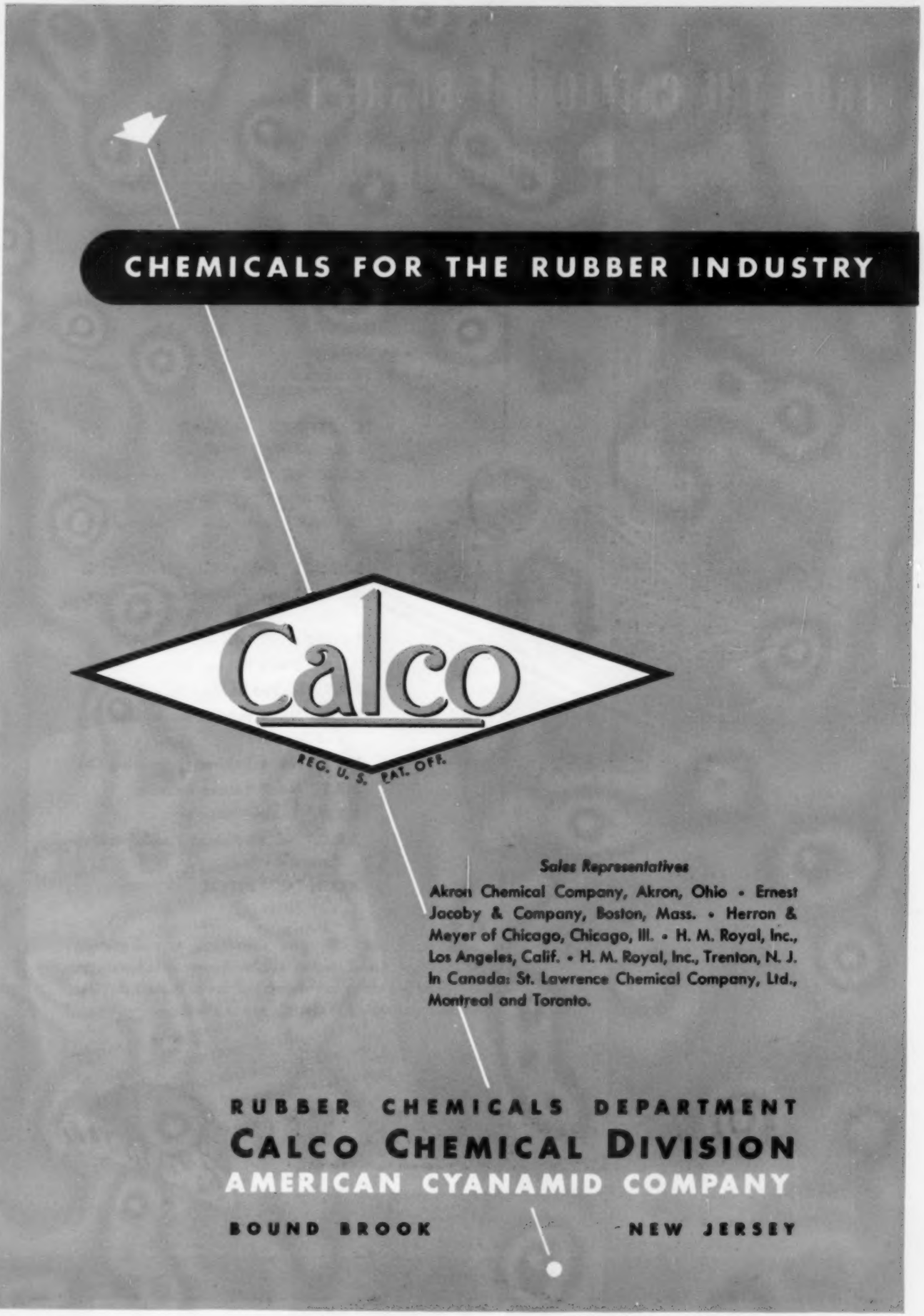
CHEMICALS FOR THE RUBBER INDUSTRY
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REG. U. S. PAT. OFF.
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RUBBER CHEMICALS DEPARTMENT
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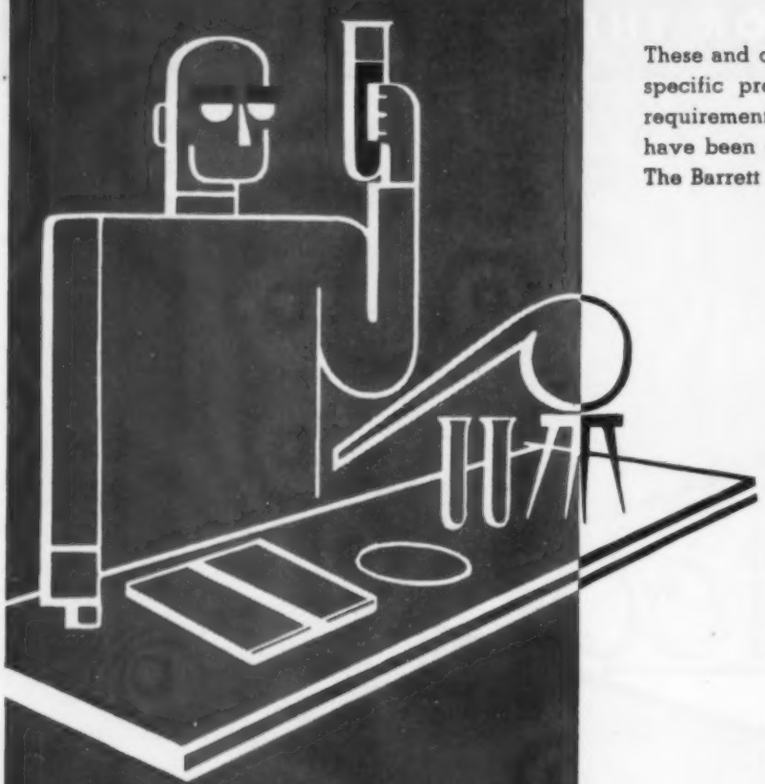
FROM THE CATALOG OF BARRETT

RUBBER COMPOUNDING MATERIALS...



These and other hydrocarbons and oils, each with specific properties to fulfill a particular set of requirements in the rubber and allied industries, have been developed over a period of years by The Barrett Division.

CARBONEX* Rubber Softener and Extender

CARBONEX* S Rubber Softener and Extender

CUMAR* Paracoumarone - indene Resin

BARDOL* Rubber Compounding Oil

BARDOL* B Rubber Compounding Oil

DISPERSING OIL No. 10

B.R.H.* No. 2 Rubber Reclaiming Oil

B.R.S. No. 700 Rubber Softener

B.R.T.* No. 3 Rubber Reclaiming Oil and Saturant

B.R.T.* No. 4 Rubber Reclaiming Oil

B.R.T.* No. 7 Rubber Softener

B.R.V.* Rubber Softener

B.R.C.* No. 20 Rubber Plasticizer and Extender

RESIN "C"* PITCH

The Barrett Division maintains a completely equipped and staffed Rubber Research Laboratory. Your inquiries involving the use of Barrett Rubber Compounding Materials are invited.

THE BARRETT DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

In Canada: The Barrett Company, Ltd.,
5551-61 Hubert Street, Montreal, Que.

*Trade-mark Reg. U. S. Pat. Off.

Barrett*

UNITED ROLLS

FOR THE RUBBER INDUSTRY

UNITED manufactures every type of roll used in the production and processing of natural or synthetic rubber. The superiority of UNITED ROLLS has been demonstrated for more than 30 years in plants of the principal rubber manufacturers of the world.

Comprehensive technological experience, advanced engineering skill, modern production facilities, and UNITED'S internationally recognized leadership in the design and construction of rolls are your guarantee of complete satisfaction.

When planning replacements or installation of new production equipment, you'll find it to your advantage to specify ROLLS by UNITED.

Rolls of ALL SIZES . . . ALL TYPES for
WASHERS CRACKERS REFINERS
MILLS CALENDERS

UNITED ENGINEERING & FOUNDRY CO.
PITTSBURGH, PENNA.
Plants at PITTSBURGH, VANDERGRIFT, NEW CASTLE, YOUNGSTOWN, CANTON
Subsidiary: Adamson United Company, Akron, Ohio
Affiliates: Davy and United Engineering Company, Ltd., Sheffield, England
Dominion Engineering Works, Ltd., Montreal, P. Q., Canada

U&F&CO

UNION PACIFIC

TREASURE MAP OF INDUSTRY

Utah *

Herbert B. Maw, Governor of Utah, tells his state's story.

"Nature was kind to Utah. Deposited within her borders are rich and varied sources of coal and iron, lead and zinc, copper, silver and gold. These and many other industrial attributes are part and parcel of the undeveloped sections of this state.

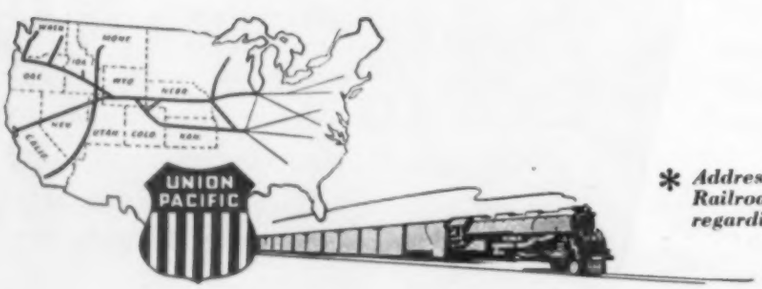
"A gigantic steel industry which can serve the west signals our industrial ambition. It will form the nucleus of a network of associated industries.

"Our need now is people and leadership to share in the prosperity of a western empire. Our natural resources are practically untouched. They assure a long life to an industrial future which is just now beginning. Utah invites new and expanding industry to investigate opportunities here before deciding upon new locations."

★ ★ ★

For industrial resources and opportunities, look to Utah. For unexcelled rail transportation . . .

* *One of a series of advertisements based on industrial opportunities in the states served by the Union Pacific Railroad.*

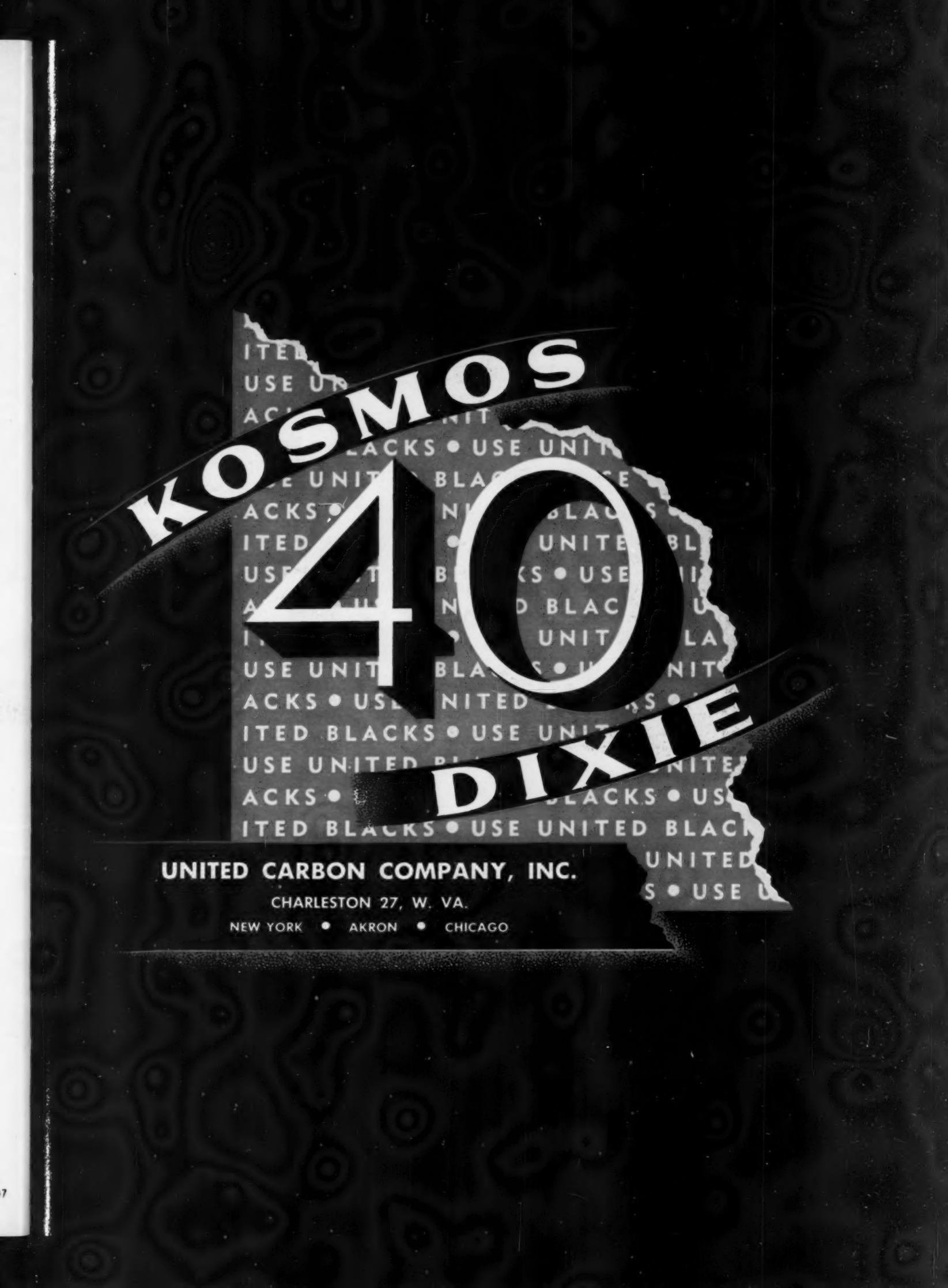


be Specific – say "Union Pacific"

* *Address Industrial Department, Union Pacific Railroad, Omaha 2, Nebraska, for information regarding industrial sites.*

UNION PACIFIC RAILROAD

THE STRATEGIC MIDDLE ROUTE


KOSMOS
40
DIXIE
UNITED CARBON COMPANY, INC.
CHARLESTON 27, W. VA.
NEW YORK • AKRON • CHICAGO

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ACKS • USE UNITED BLA
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UNITED

DIXIE 40 HMF and KOSMOS 40 HMF have these desirable characteristics—cool mixing, easy processing, smooth and rapid extrusion, fast rate of cure, full reinforcement, low heat build-up, high resiliency and high resistance to cut-growth, flex cracking and abrasion. DIXIE 40 and KOSMOS 40 are furnace type reinforcing carbon blacks, produced by a special process under carefully controlled conditions, especially useful for tires of all types, tubes, footwear and mechanical goods.

RESEARCH DIVISION

UNITED CARBON COMPANY, INC.

Charleston 27, West Virginia

• In the compounding of neoprene, K&M Light Magnesium Oxide has *proved* that top quality pays off. That is why so many leading neoprene compounders insist on K&M Light Magnesium Oxide.

Originating in crude Dolomite rock, this feather-light powder was carefully developed by America's pioneer manufacturer of magnesia products to meet the specific needs of neoprene compounders. One grade only is produced . . . the *finest.*

K&M Light Magnesium Oxide is available now . . . order it from one of the stock points listed below.

Neoprene-covered seismograph cable
Photo Courtesy: General Geophysical Company

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

One of America's oldest and most reliable makers of asbestos and magnesia products

OUR DISTRIBUTOR FOR K&M LIGHT MAGNESIUM OXIDE IS
AMERICAN CYANAMID COMPANY
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WITH SALES REPRESENTATIVES TO THE RUBBER INDUSTRY AND STOCK POINTS:
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BOSTON, MASS., Ernest Jacoby & Company
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TRENTON, N. J., H. M. Royal, Inc.

What characteristics do you require in Zinc Oxides?

The St. Joseph Lead Company produces specific types or grades of lead-free zinc oxides for the rubber, paint and other zinc oxide consuming industries. Irrespective of what your individual requirements may be, you will find that the pigment recommended by our technical staff will possess the characteristics considered most desirable for your particular purpose.

St. Joe lead-free Zinc Oxide is produced direct from our own ore by a patented Electro-Thermic Process which permits unusually close control to be exercised in every phase of production. This makes it possible to maintain the exceptionally high standards of quality and uniformity for which St. Joe Zinc Oxides are recognized throughout the consuming industries.

ST. JOSEPH LEAD COMPANY

250 PARK AVENUE • NEW YORK 17 • ELdorado 5-3200

Plant & Laboratory: Josephtown, Beaver County, Pennsylvania

Showing microscope and equipment for examination of physical characteristics and particle size of St. Joe Zinc Oxide in our laboratories at Josephtown, Pa.

ST. JOE Lead-Free ZINC OXIDE

For chemical purity plus... Specify B&A REAGENTS

In selecting reagents for your laboratory, specify B&A for *chemical purity* PLUS *product diversity and availability:*

The PURITY . . . guaranteed by the skill, science and technological developments which General Chemical Company's Baker & Adamson Division has gained in 65 years of "Setting the Pace in Chemical Purity."

The DIVERSITY . . . more than 1,000 purity products bear the B&A "Shield of Quality." From them you can order your every requirement.

The AVAILABILITY . . . extensive stocks of B&A Reagents are maintained in the Company's *own* regional distributing stations from coast to coast. The one serving your territory can supply your month-to-month needs swiftly, surely, steadily.

Remember this when you buy laboratory reagents. Specify B&A for *chemical purity* PLUS *product diversity and availability*—advantages that really count in operating any laboratory efficiently. Your B&A Technical Serviceman can start special, personalized service for you today. Phone or write the nearest office below.

REAGENTS
BAKER & ADAMSON B&A QUALITY
STANDARD OF PURITY
FINE CHEMICALS

GENERAL CHEMICAL COMPANY

BAKER & ADAMSON DIVISION

40 RECTOR STREET, NEW YORK 6, N. Y.

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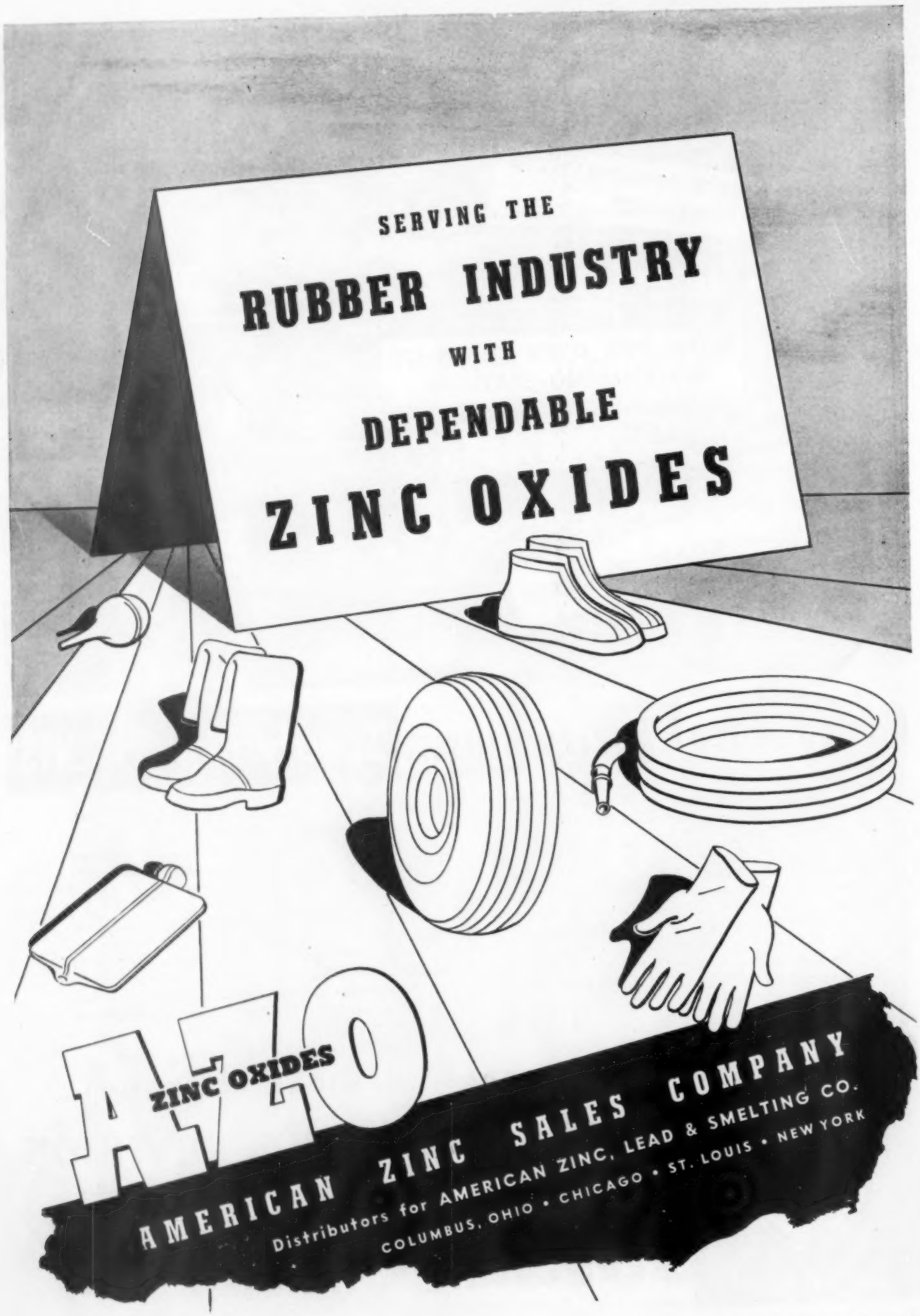
SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

*Complete stocks carried here.


SERVING THE
RUBBER INDUSTRY
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AMERICAN ZINC SALES COMPANY
Distributors for AMERICAN ZINC, LEAD & SMELTING CO.
COLUMBUS, OHIO • CHICAGO • ST. LOUIS • NEW YORK

Fabric Uniformity means Product Uniformity

BECAUSE THE UNIFORMITY of your rubber products can be only as good as the fabric employed, successful production depends, to a large extent, on the uniformity of the fabric used. MT. VERNON fabrics have *that constant uniformity*. Made from choice grades of cotton and woven under rigid laboratory controls, they make for consistent product quality. For better results—specify MT. VERNON fabrics.

uniformity makes the big difference

TURNER HALSEY
COMPANY
Selling Agents
40 WORTH ST. • NEW YORK

Mt. Vernon-Woodberry Mills

Branch Offices: CHICAGO • NEW ORLEANS • ATLANTA • BALTIMORE • BOSTON • LOS ANGELES • SAN FRANCISCO

RECLAIMED RUBBER

Better processing and better reclaims have always been our aim.

Our reputation for uniformity and fine finish at competitive prices is well known wherever reclaims are used.

PEQUANOC RUBBER CO.

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European Representatives
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Harrow-On-Hill, Middlesex, England

Accelerators
Plasticizers
Antioxidants

A Complete Line of Approved Compounding Materials

The C. P. Hall Co.
CHEMICAL MANUFACTURERS

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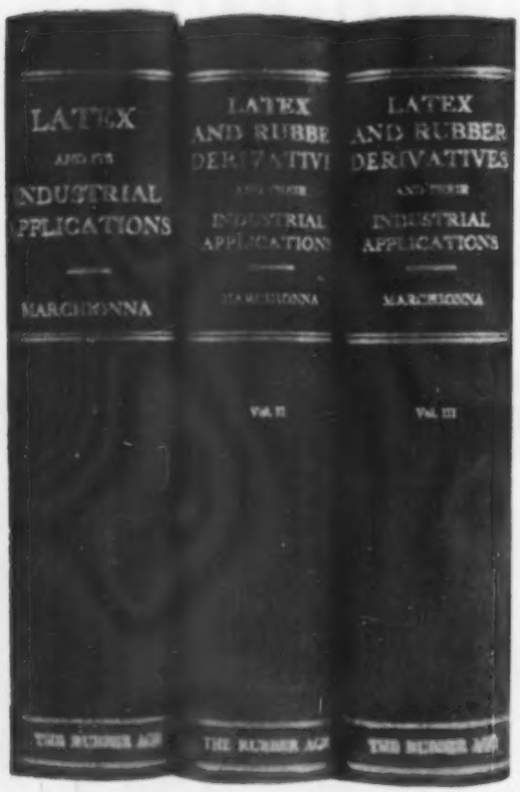

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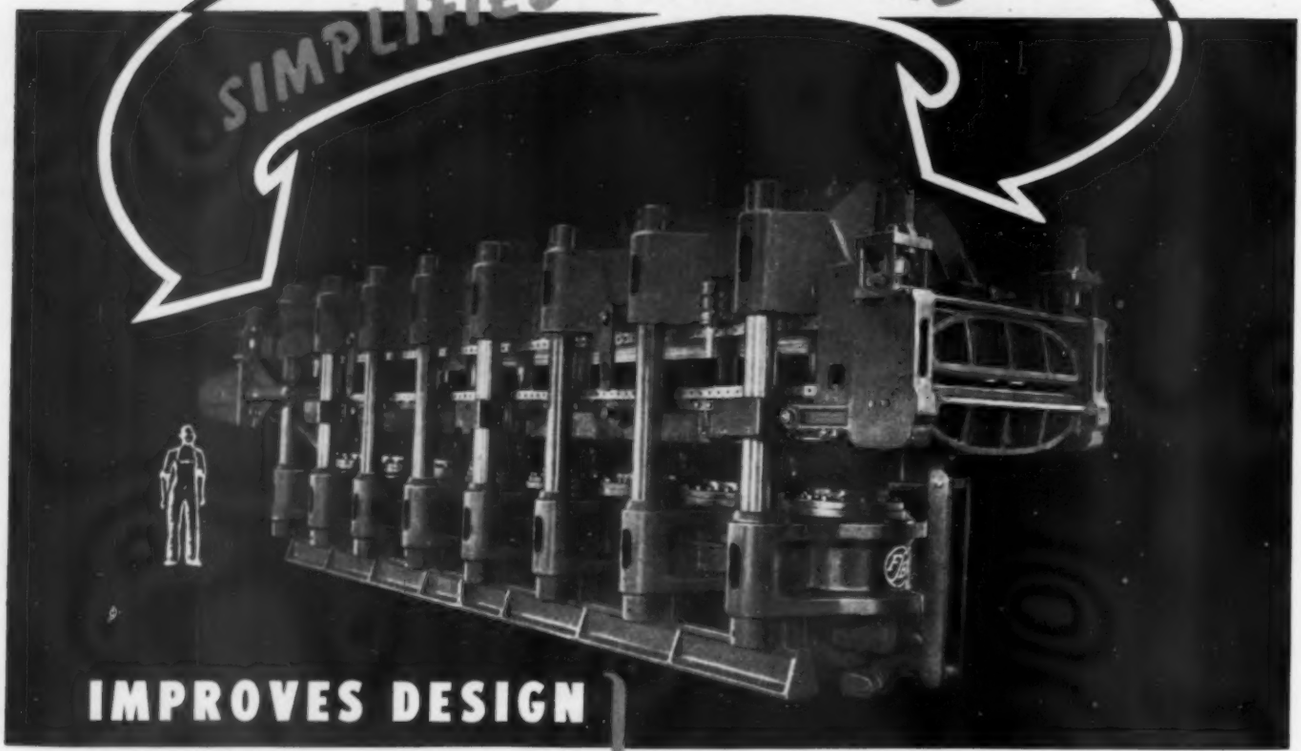

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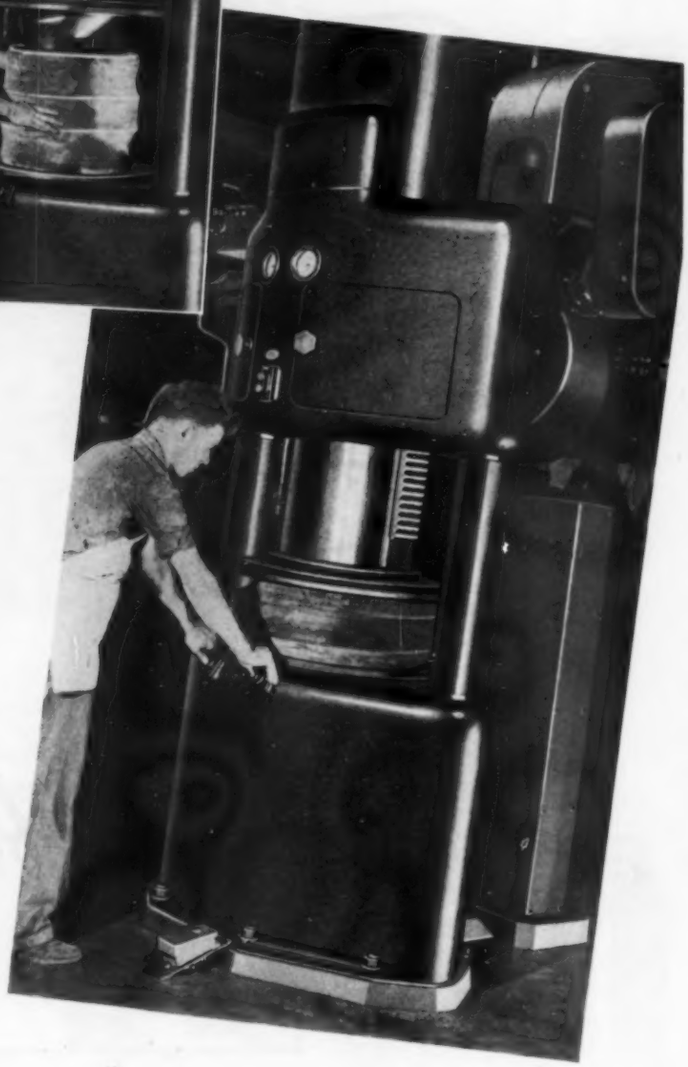

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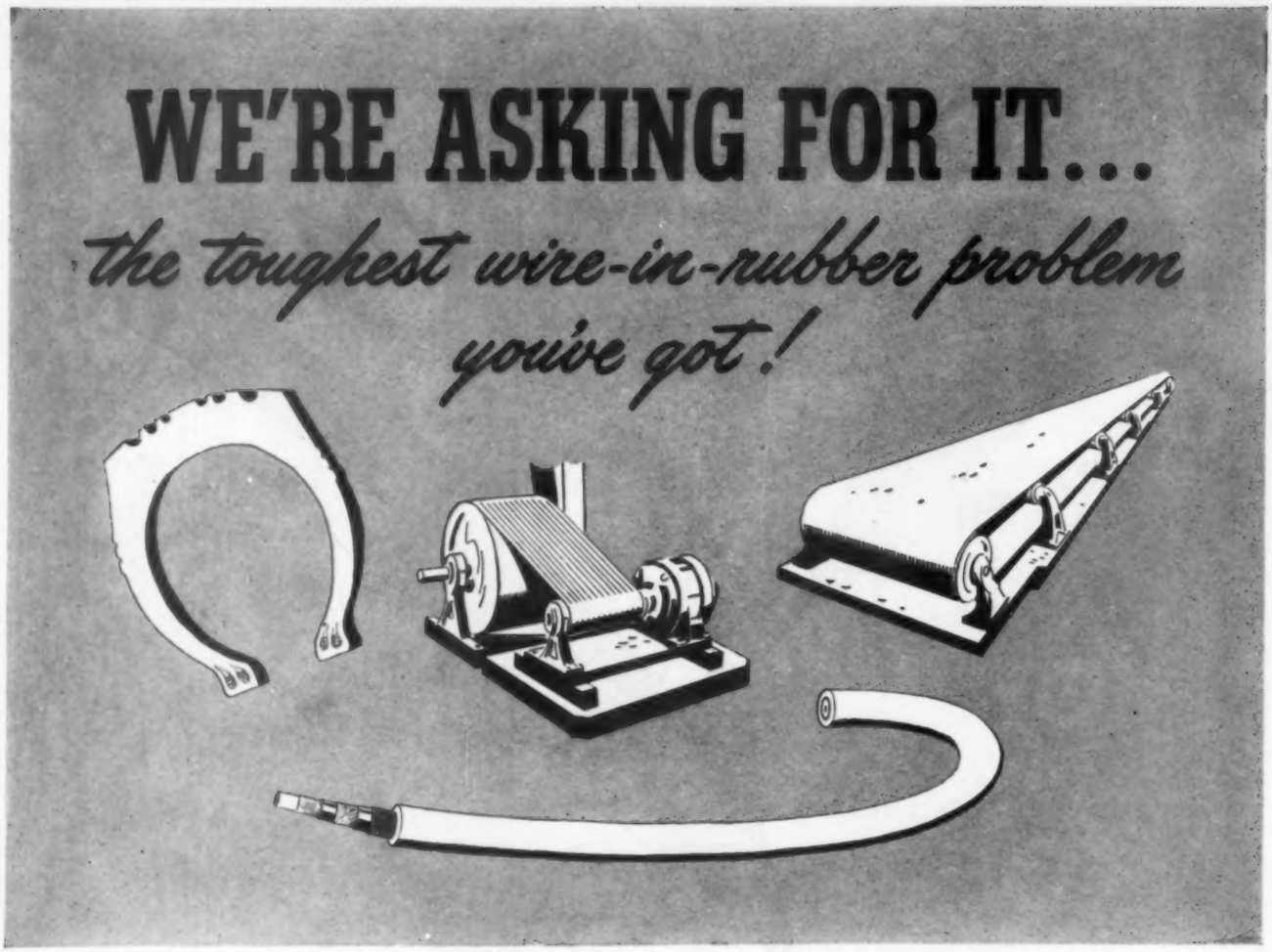

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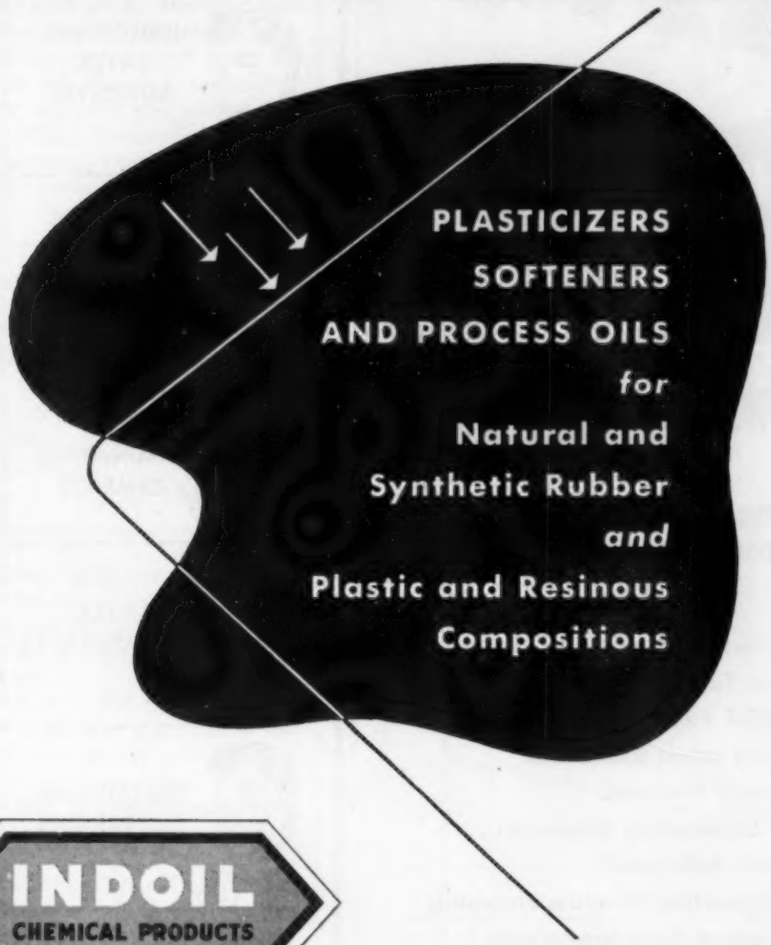

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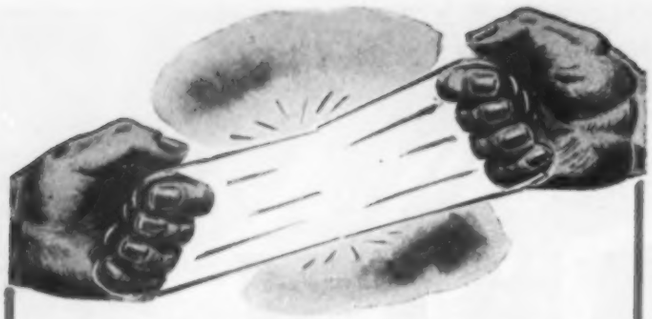

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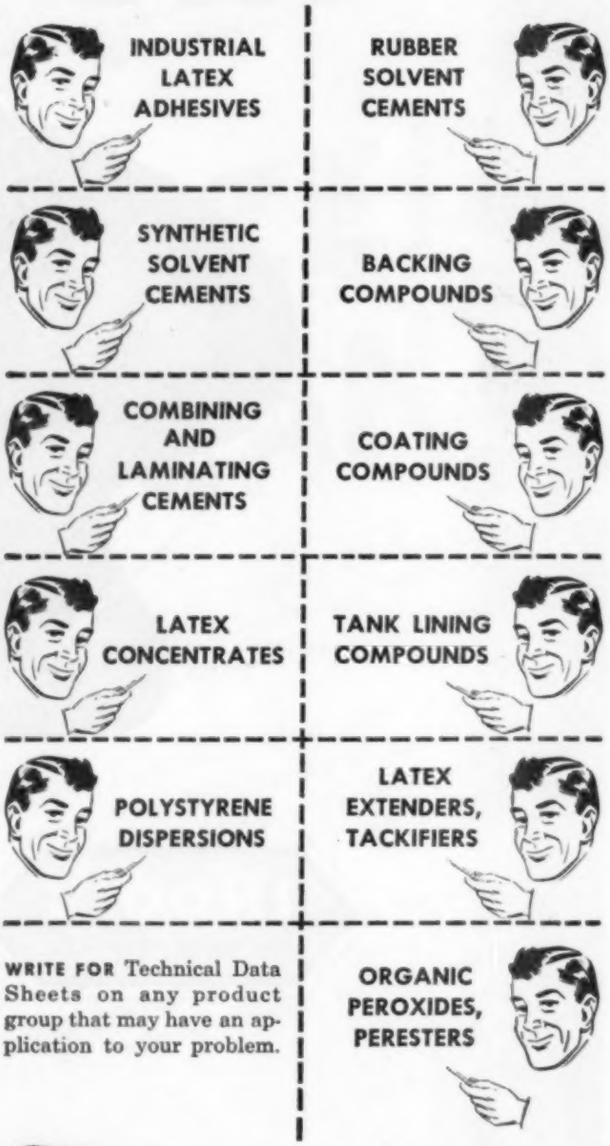

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Technical Bulletin No. 30 — on the Compounding of GR-S with Substantial Loadings of Zinc Oxide

Blends of X-285 and GR-S with 100 Parts of Zinc Oxide

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COMPOUND No. 30

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Coumarone-indene resin	7.5
E.L.C. Magnesia	5.0
ZINC OXIDE	100.0

X-285 is a new cross-linked polymer for special applications. Used alone it develops low tensiles but high modulus, with correspondingly low elongations. It is intended to be used with standard GR-S in amounts of from 10 — 50 parts.

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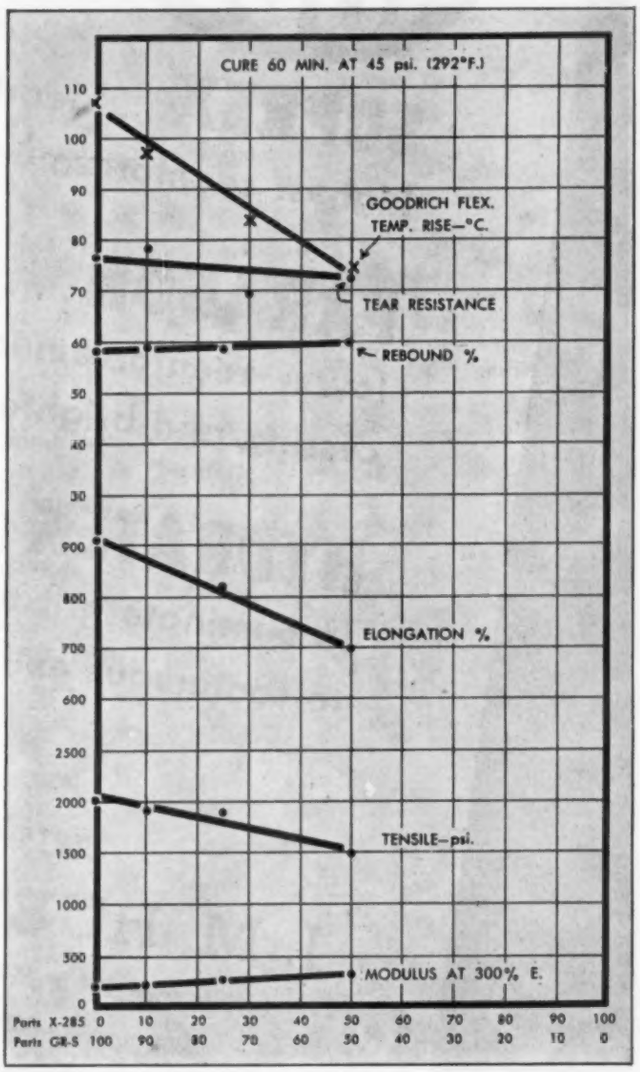
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The RUBBER AGE

VOLUME 60

NUMBER 6

One of the World's Outstanding Rubber Journals

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RUBBER AGE

Vol. 60, No. 6 MARCH, 1947

Laboratory Testing of Rubber Torsion Springs

By D. H. CORNELL and J. R. BEATTY

Physical Research Laboratory, B. F. Goodrich Co., Akron, Ohio

RUBBER is commonly used in shear for vibration isolation. The Torsilastic cylindrical spring by virtue of its geometry has certain inherent advantages over other types of shear springs. This rubber torsion spring consists of three essential members: (a) the intermediate member of flexible rubber, securely bonded to two rigid hollow cylindrical shells forming a (b) inner and (c) outer member.

The solid rubber sleeve is relatively soft and securely bonded to the metal shaft and shells. One of the rigid members is held stationary while the other is deflected in a torsional direction, producing a "windup" in the rubber. The torque required to deflect this rubber torsion spring is nearly proportional to the angular deflection.

Advantages of Rubber Torsion Springs

The rubber torsion spring has virtually no static friction. Relatively long rubber torsion springs are inherently stable, eliminating the necessity of spring guides and many spring shackles or other linkages that introduce friction into conventional suspensions. The solid rubber between the two metals functions as a dust and dirt seal. Any foreign material present which would score or damage bearings is effectively shielded from the interior of the spring. Since the deflection takes place in the elastomer the rubber functions without a lubricant. Thus rubber torsion springs are free from static friction, are in themselves stable, function as their own dust seal and require no lubrication.

Working stresses of 120 to 150 psi are quite common, and laboratory tests at 300 psi and elevated temperatures have been attained without troublesome bond breaks. Remembering that it is conventional practice to design flat plate or pure shear type rubber springs with working stresses near 50 psi, it is easy to realize that the torsion type rubber spring uses the elastomer much more efficiently. The reason for this great gain can be easily understood if one imagines a simple flat plate spring bent into the shape of a cylinder until the two ends join and so are eliminated. It is the great stress concentrations at the ends of the flat plate springs which limit their use.

Thus the torsion type spring has completely eliminated the end and has only edges to act as stress raisers. This effect can be greatly minimized by designing the edge contour to eliminate stress concentrations. Stress concentrations at the edges are reduced further if a layer of unstressed rubber is molded with the body of the spring on both the shaft and shells as illustrated in Fig. 2. The drawing in Fig. 2 is a cross section of the spring shown in Fig. 1.

There is almost no end to the versatility of torsion spring design because the length of torque arm, the rubber thickness, the rubber length, and the hardness of rubber can all be varied. By combining these elementary factors in the proper manner, springs having

Note: This article is based on a paper delivered by Mr. Cornell before the Rubber and Plastics Division, American Society of Mechanical Engineers, in New York, N. Y., on December 2, 1946.

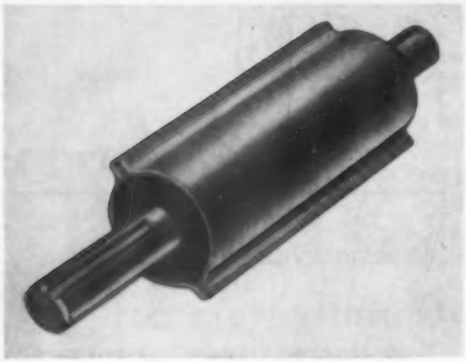

FIG. 1—Torsilastic spring.

a torque capacity of a few lb.-in. to torques of several million lb.-in. can be readily produced. It is also possible to design mechanisms using rubber torsion springs and obtain non-linear load deflection characteristics.

Uses of Rubber Torsion Springs

This type of spring is not new. Experiments have been performed on them for several years. An earlier discussion was published by Krotz *(1)* in 1939. The springs are adaptable to mass production applications such as automobiles, trucks and busses. However, they also have great advantages for hundreds of miscellaneous small production items ranging from children's toys to heavy industrial machinery.

Rubber torsion springs proved their worth during the war as bogie pivot supports for amphibious tanks, ramp gate counter balanced hinges, and in other applications. More than one-half million rubber torsion springs have been made and placed in service.

Properties Studied

There are many properties that influence the behavior of rubber torsion springs. Properties such as lack of static friction, inherent stability and others are obvious and need not be investigated. Other properties, such as (1) static deflection under load, (2) ability to isolate vibration by virtue of their dynamic properties, (3) fatigue or service life and (4) temperature effects, are not so obvious and need investigation.

All of these are somewhat complicated and usually not simple to measure. The vibration isolating ability, or the riding quality of an automotive spring, will depend on the dynamic rate or modulus. This can be determined by reversing the direction of loading in Fig. 3 a small amount and allowing the spring system to oscillate about the point on the torque-windup curve where the dynamic modulus is desired. The dynamic modulus is the average slope obtained in such a cyclic loading. It can be measured more directly and conveniently by supporting a load on a torsion spring and determining the natural frequency of vibration of the system. This property varies with temperature.

The windup under load is usually determined from a so-called static curve, that is, one obtained by increasing the load at a relatively slow speed, being careful not to reverse the windup. An example of such a curve is shown in Fig. 3. The windup at any load can be read from this curve, but it will be modified by creep, which will increase the windup somewhat at first and then at a decreasing rate throughout the life of the spring. Compensations can be made for early creep in the original design. Simple adjustments can be made for long time creep, but it is often so low that it may be neglected entirely.

Variations in temperature will change the windup. Raising the temperature will diminish the windup, while lowering the temperature will increase the windup if this temperature change takes place while the spring is stressed. This is the familiar Joule effect and can be measured directly by varying the temperature of the stressed spring.

The fatigue life will depend on the stress and the amplitude of vibration. It will vary more with temperature than the other important properties.

An attempt has been made to devise methods of measuring these properties in the laboratory with reasonable speed and convenience, and in most cases the results agree with service performance or at least indicate the direction for improvements.

Methods of Measuring Fundamental Properties

Test data have been obtained on springs of two sizes. The larger test spring has rubber dimensions of 3.25" O.D., 1.50" I.D. and 9.40" long. The smaller spring

DESCRIPTION	O.D.	I.D.	RUBBER LENGTH
SMALL SPRING	1.08"	0.50"	3.10"
LARGE SPRING	3.25"	1.50"	9.40"

FIG. 2—Cross section of the small rubber torsion spring test piece.

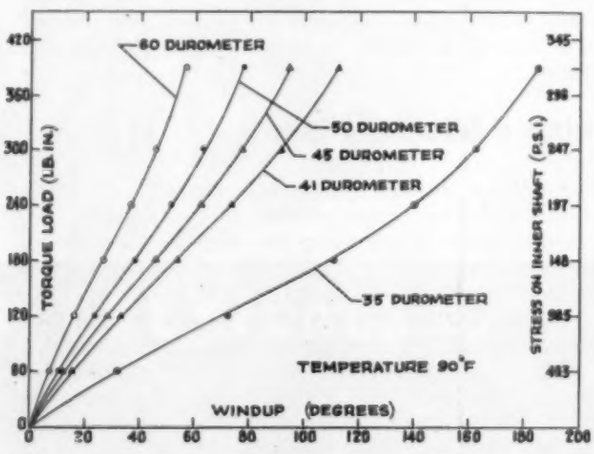

FIG. 3—Torque versus windup.

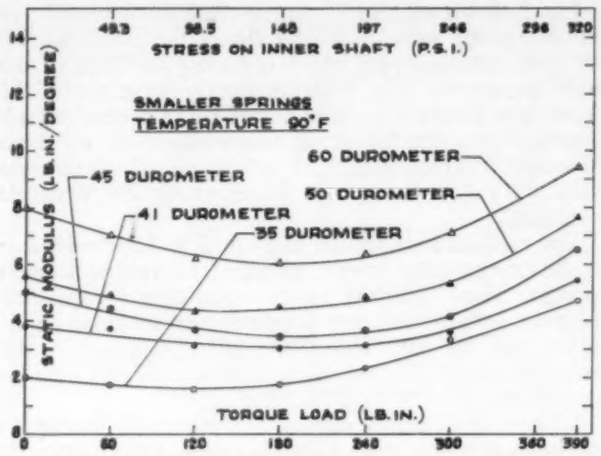

FIG. 4—Static modulus versus torque.

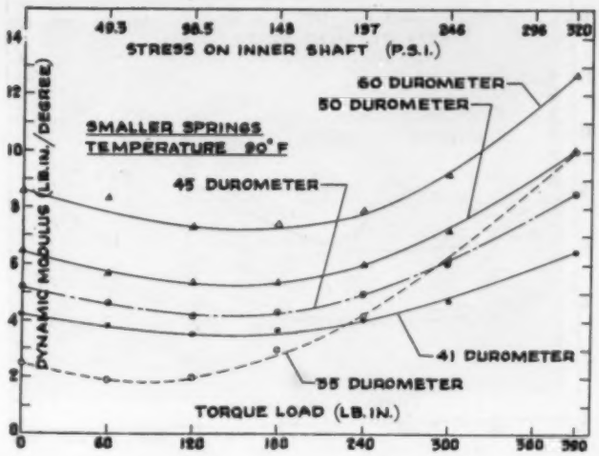

FIG. 5—Dynamic modulus versus torque.

is approximately ⅓ scale size of the larger. In this paper all modulus data were obtained on the smaller spring, while all fatigue and creep data were obtained on the larger spring. The use of two sizes of springs was merely a matter of expedience and is without significance since the results obtained with the two sizes of springs are altogether comparable.

Although springs of various hardnesses were tested each spring was of rubber of the same hardness throughout, that is, no tie gums were used. Static torque-windup curves were found by applying various static torques to the spring and measuring the windups. The static modulus can be determined by measuring the slope of these static torque-windup curves. Data for dynamic modulus can be obtained by oscillating the loaded spring together with the torque producing weights and measuring their natural frequency. The dynamic modulus can be calculated from the natural frequency and the moment of the inertia of the system. From the familiar formula of simple harmonic motion

$$f_1 = \tfrac{1}{2}\pi\sqrt{K_1 g / I_1}$$

where

f_1 = natural frequency (cycles/sec.)
K_1 = dyn. rate = torque/deflec. (lb.-ft./radian)
g = acceleration of gravity (ft./sec.^{2})
I_1 = moment of inertia of the system (lb.ft.^{2})

the value of K_1 is found to be

$$\frac{4\pi^2 f_1^2 I_1}{g}$$

Or reduced for purposes of computation where

f = natural frequency (cycles/min.)
K = Dyn. rate [torque/deflec.] (lb.in./deg.)
I = moment of inertia of the system (lb.in.^{2})

$$K = 5.0 \times 10^{-7} f^2 I$$

Ultimate fatigue life for the rubber springs was found by loading the test piece with weights hung on a torque arm. The spring was then caused to oscillate at its natural frequency by periodically unwinding the spring a known amount and releasing it. Tests were accelerated by enclosing the spring in an oven at elevated temperature. The number of excitations at the time of break indicate fatigue life.

Static creep conditions can be determined by loading a torsion spring and measuring the change in static deflection. Creep under dynamic conditions was determined while the fatigue tests were being run.

Quantitative Data

All compounds on which data are reported were standard factory molded goods stocks of various hardnesses. They were selected because they were available at the start of the torsion spring program, and are not the best selection for their respective hardnesses for use in Torsilastic springs. Because of differences in the recipes employed, the properties measured do not in all cases correlate with changes in hardness.

Modulus Results: Torque-windup and modulus relations were secured by using custom built laboratory apparatus which is described in the appendix of this paper. The rubber torsion spring embraces a range of stresses because the stress of the rubber varies inversely with the square of the radius of the spring. For a matter of convenience loads are expressed as rubber stress at the shaft in lbs./in.^{2}, or as units of applied torque in lb.in. Deflections or windups are measured in degrees and moduli or spring rates are expressed as lbs.in./deg.

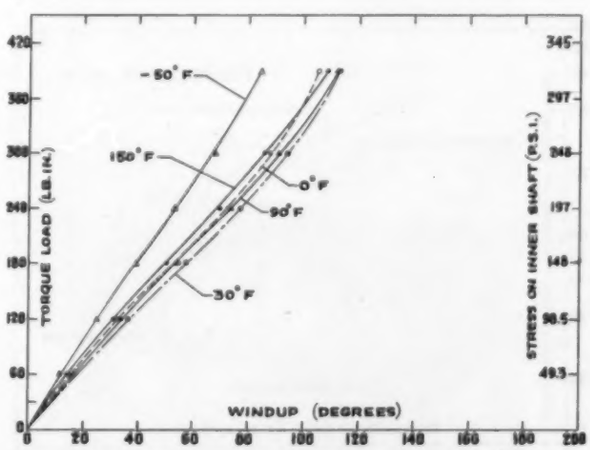

FIG. 6—Torque versus windup for 41 Durometer compound.

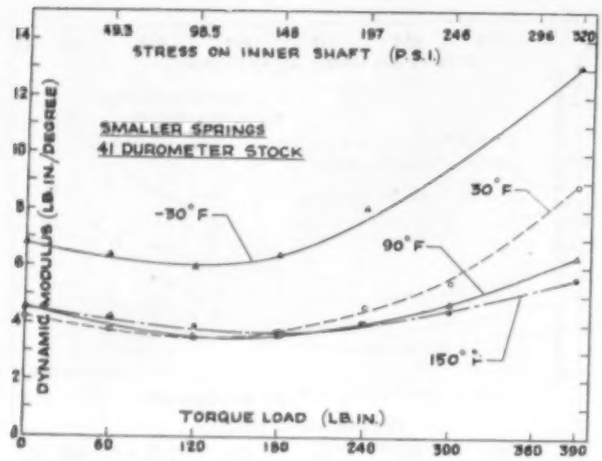

FIG. 7—Dynamic modulus versus torque for 41 Durometer compound.

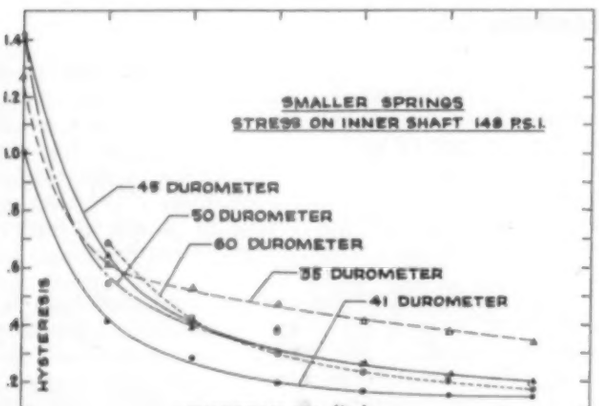

FIG. 8—Hysteresis versus temperature.

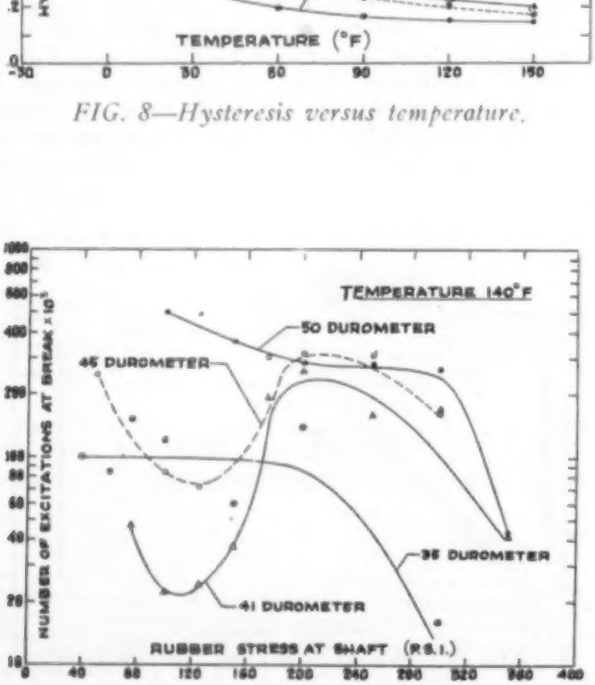

FIG. 9—Fatigue life versus stress.

Fig. 3 shows a series of torque-windup curves of five typical spring stocks. Fig. 4 shows the static moduli for these same springs, which is merely the slope of the previous curves. Fig. 5 shows the dynamic moduli of these same stocks at frequencies of 1 to 3 cycles/second. Fig. 6 shows the effect of temperature on the load deflection characteristics of a typical 41 durometer stock. Fig. 7 shows the same effect on dynamic modulus.

The relationships shown in Figs. 3 to 7 inclusive are to illustrate typical curves obtained on rubber torsion springs. More complete fundamental data from which the most suitable size and design for a particular application can be determined are included later in the section entitled "Mathematical Calculations and Fundamental Data."

Whenever damping curves are recorded, hysteresis can be easily computed. Fig. 8 is a plot of the hysteresis of the five stocks at 148 psi shaft stress vs. temperature. Hysteresis is expressed here as the logarithmic decrement, or $\log_e$ of the ratio of the heights of two consecutive peaks on the same side of the axis of the damping curve. By suitable compounding techniques, stocks having lower hysteresis at low temperatures can be prepared.

Fatigue Results: The fatigue life of rubber at various stresses is not a simple function. Fig. 9 shows the relationship found experimentally between the number of excitations at break and the rubber stress at the shaft for torsion springs. Fig. 10 shows the same fatigue data plotted against initial strain in degrees. The general trends found check with data previously published by Yost *(2)* and Dillon *(3)*. These investigations published by the other experimenters also show the reduction in life as stress increases, followed by a phase where longer fatigue life results from increasing stress. An optimum fatigue life is then found at a relative high stress and again the life decreases with increasing stress. These curves show that higher durometer stocks are preferable if high stress in the spring is important to suit the application. If a soft spring with high deflections is needed it will be advantageous to use lower durometer hardness stocks.

Fatigue breaks in the rubber of flexed torsion springs can be classified in two general ways—low strain breaks

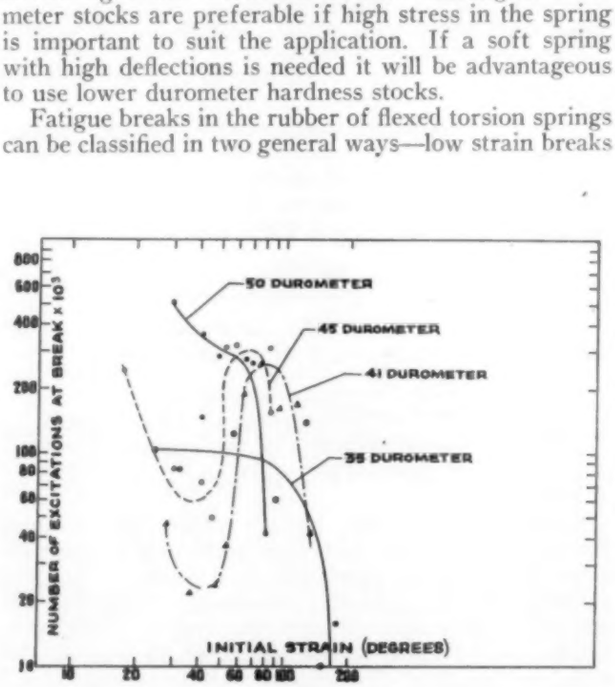

FIG. 10—Fatigue life versus strain.

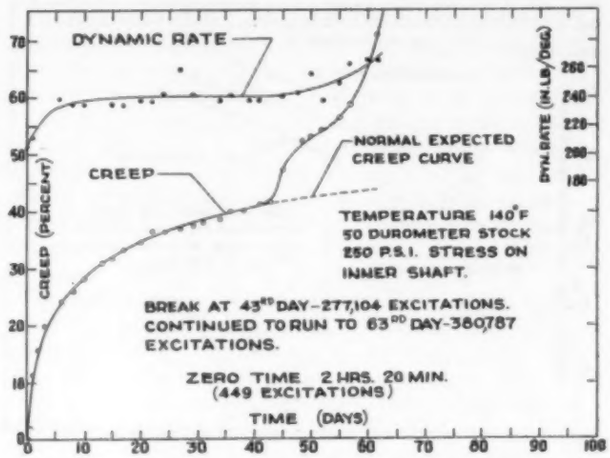

FIG. 11—Accelerated creep and dynamic modulus versus time.

and high strain breaks. Low breaks occur in a zone starting near the shaft and extending outward for 1/16" to 1/8". This type of break will not run through the cement to the metal but will form a jagged, irregular surface. Breaks of this type usually start midway between the edges and progress slowly toward both edges in a lengthwise direction. This slow progressive break makes the detection of the initial break or the end point of the fatigue test difficult to determine. All of the break of the rubber is entirely internal and cannot be seen. The only outward indication of the break is shown by an abnormally high creep rate.

Fig. 11 shows a typical accelerated dynamic creep curve. The dotted extension of the creep curve indicates the expected results if the spring had not broken. Many tests have been run for weeks after evidence of the first break was detected. A typical low strain break is shown in Fig. 12. Breaks in springs at high strains occur suddenly and form surfaces of a characteristic spiral shape extending almost laterally along the spring. These spiral surfaces seem to begin at or near the shaft and progress outwardly to the shells perpendicular to lines of tension of the stressed spring.

A brief investigation of the combined stresses indicates (within the experimental accuracy of the work) that rubber in a torsion spring breaks in tension rather than in shear. It can be shown analytically that the family of surfaces perpendicular to the lines of maximum tension approach radial surfaces as the strain increases. Two views showing the direction of a high strain break are shown in Figs. 13 and 14. Measurements made of the spirals found in broken springs compare favorably with the calculated location of these surfaces perpendicular to the lines of maximum tensile strain.

It is also believed that low strain tests support the contention that the breaks are perpendicular to lines of maximum tension even though the characteristic spiral break is not found. This is due to two reasons: (a) the family of surfaces perpendicular to the lines of maximum tension become very long and (b) the rubber stress varies inversely with the radius squared. For these two reasons the rubber break will return to the highly stressed rubber near the shaft rather than continuing in the long original surface.

In all the discussion on fatigue results, no mention has been made of adhesion breaks between the rubber

FIG. 12—Low strain break.

and the metal. Fig. 15 shows the appearance of a typical adhesion break. Such failures are either the result of poor workmanship in constructing the spring or a poor design which did not eliminate detrimental stress concentrations. An inspection of the illustrations of Figs. 12, 14 and 15 shows markedly the difference between typical adhesion and low stress breaks. The data on any test piece which showed adhesion breaks were disregarded and an investigation was made to determine the cause of these abnormal results.

Periodic determinations were made on the dynamic rate of the springs while they were being subjected to fatigue tests. In general, a slight increase in dynamic rate was found for the first day or two. The dynamic rate would soon reach a nearly constant value. It is of

FIG. 13—High strain break.

FIG. 14—Another view of a high strain break.

FIG. 15—Adhesion failure.

interest to note that the dynamic spring rate remains nearly constant even though the spring breaks. Many times in cases of low stressed springs, internal breaks would be indicated by the creep curves, but for all practical purposes the dynamic rate would not change. This phenomenon is also illustrated in Fig. 11. All of the fatigue results discussed are at 140°F. No base line has been established with room temperature results because the springs did not break at 80°F. even though tests were made continuously on 41 durometer stocks for a period of five months, during which these springs were subjected to one million excitations.

Accelerated Creep Results: Static creep data for flat plate springs have been previously reported by Hahn and Gazdik *(4)*. We have now obtained accelerated dynamic creep data for torsion springs, which were recorded on the larger test pieces as a by-product of the fatigue tests. Since rate of creep is nearly proportional to stress it is convenient to express creep as a percent of initial windup. Due to the difficulty of loading the large test pieces rapidly and uniformly, the initial windup is defined as the windup due to the test load plus the creep experienced through the first 0.1 day.

Figs. 16 and 17 show accelerated creep at 140°F. as a percent of initial windup versus time. The data are shown on rectangular and log-log coordinates respectively. These values of accelerated creep are the average of data obtained at various stresses. These data

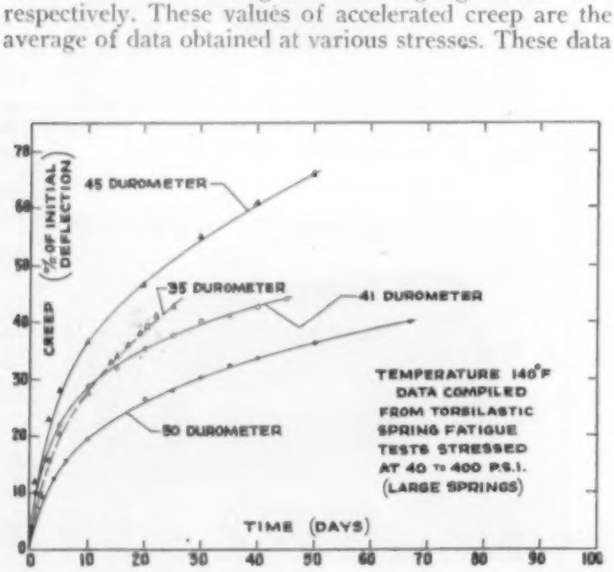

FIG. 16—Accelerated creep versus time.

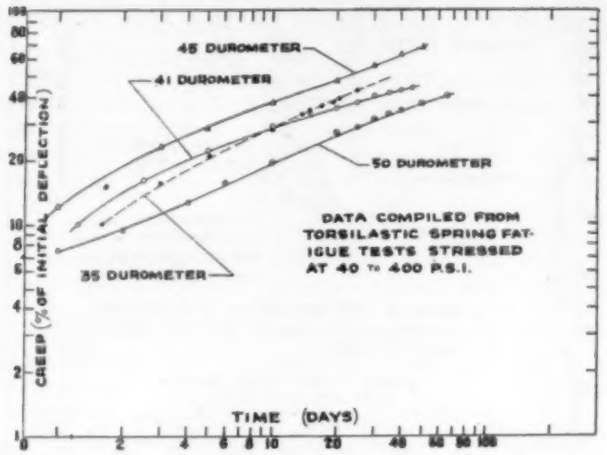

FIG. 17—Accelerated creep versus time.

are not necessarily for the best compounds for torsion springs. Fig. 18 has been included to show how well the accelerated creep data at various stresses agree when expressed as a percent of original windup and plotted together on common coordinates.

Mathematical Calculations and Fundamental Data

No mention need be made of the fundamental principles of vibration isolation as this subject has been well described by other authors *(5-8)*. A mathematical treatment of many geometric shapes used in rubber springs has been published by Smith *(9)*.

In considering the theoretical design of any torsion spring to determine its load deflection properties, Harris *(10)* in his paper has presented a new and unique method of determining the dynamic and static torque-windup properties. This determination can be made if the rubber dimensions are assumed and a fundamental property of the rubber which he calls polar strain is known. Polar strain is similar to conventional pure shear strain except that the units are lbs./in.^{2} vs. degrees for polar strain as compared with lbs./in.^{2} vs. inches/inch for pure shear strain.

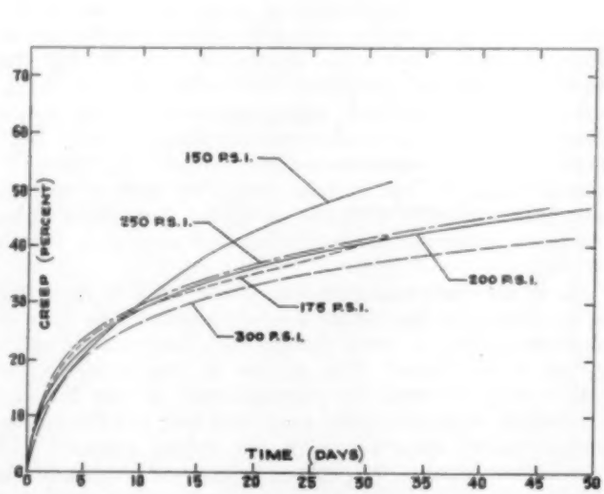

FIG. 18—Accelerated creep versus time for 41 Durometer compound.

The primary data for polar strain are obtained on the modulus tester which is described in the appendix. Static torque-windup and dynamic modulus determination are made in a conventional manner at increments of load and temperature. The data of the torsion spring are then converted to fundamental or polar strain by the methods outlined by Mr. Harris. This makes it possible to perform a single conversion from data of a torsion type spring containing a range of stresses to fundamental or polar strain which is easily applicable to torsion springs of any desired dimension.

The entire stress-strain curve of any rubber torsion spring can be easily computed by compiling a table as indicated in Fig. 19. Column I is a list of the increments of torque in lb./in. The torque values should be selected to cover the range which is applicable to one's particular interests. Column II is the shear stress in lb./in.^{2} at the inside diameter of rubber. Column III is the shear stress in lb./in.^{2} at the outside diameter of the rubber.

It is easy to find the $s_{i.d.}$ and $s_{o.d.}$ by applying the following expressions:

$$s_{i.d.} = \frac{T}{2\pi r^2_{i.d.} L}$$

$$s_{o.d.} = \frac{T}{2\pi r^2_{o.d.} L}$$

where

$s_{i.d.}$ = shear stress at the inside diameter of the rubber in (lb./in.^{2})
$s_{o.d.}$ = shear stress at the outside diameter of the rubber in (lb./in.^{2})
T = the applied torque (lb.in.)
$r_{i.d.}$ = inside rubber radius (inches)
$r_{o.d.}$ = outside rubber radius (inches)
L = effective length of rubber (inches)

Column IV is the polar strain in degrees at the inside diameter of the rubber. Column V is the polar strain in degrees at the outside diameter of the rubber. Values of static polar strain (θ) can be selected from the curve for the particular compound, stress and temperature which suits the conditions. Column VI is the angular deflection ϕ in degrees or the difference between Columns IV and V. The dynamic behavior may be determined if the same procedure outlined above in Fig. 19 is used except that values of dynamic polar strain should be selected to suit the conditions. The torque-angle relation determined will be a virtual torque-windup curve, the slope of which is the dynamic rate of the rubber torsion spring in lb.in./deg.

Figs. 20 and 21 show fundamental static and dynamic polar strain data for five typical rubber stocks at one temperature. Figs. 22 and 23 show fundamental

I	II	III	IV	V	VI
TORQUE (LB.-IN.)	$S_{I.D.}$ (LB/IN^2)	$S_{O.D.}$ (LB/IN.^{2})	$\theta_{I.D.}$ (DEG.)	$\theta_{O.D.}$ (DEG.)	$\phi_{@S.I.D.}$ (DEG)

FIG. 19—Table for computing polar strain.

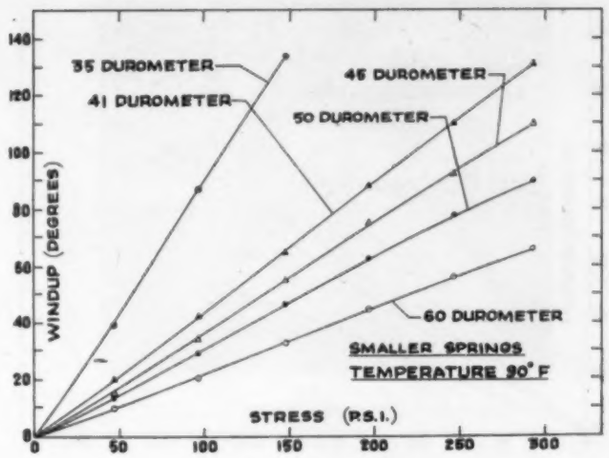

FIG. 20—Static polar strain versus stress.

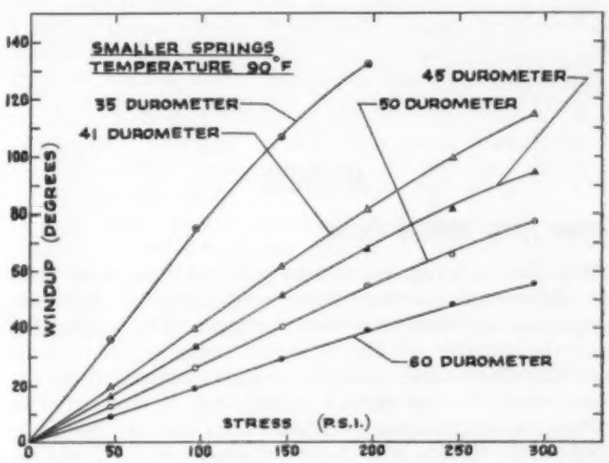

FIG. 21—Dynamic polar strain versus stress.

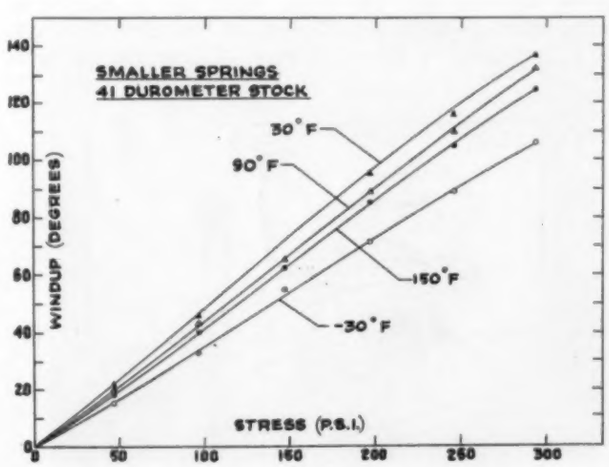

FIG. 22—Static polar strain versus stress for 41 Durometer compound.

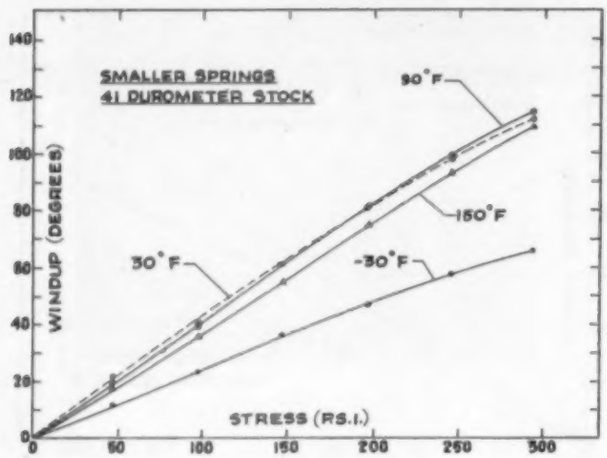

FIG. 23—Dynamic polar strain versus stress for 41 Durometer compound.

static and dynamic polar strain data for one stock over a range of temperatures. It must be remembered that mathematical expressions may often design springs that would be impractical to use. Knowledge obtained from actual tests and experience must always be kept in mind when new designs are being evaluated.

APPENDIX

Torsion Spring Modulus Testers

Fig. 24 is a schematic drawing of the equipment used to determine windup-torque and dynamic modulus properties of rubber torsion springs. This apparatus uses the smaller of the two test samples. It will be seen that the rubber torsion spring is supported on the inner shaft by two plain bearings and is connected to a worm reduction gear. A protractor and pointer fastened to the frame and the inner shaft respectively indicates windup in degrees. The outer member of the test piece is secured in a housing to which two 15" loading arms are attached.

Torque can be applied by properly adding weights to the two arms of the housing. If an unbalanced force applies torque to the housing it will cause the spring to wind up. The inner shaft can be rotated to return the spring to a null position, and a static windup is indicated by the protractor. When the spring is

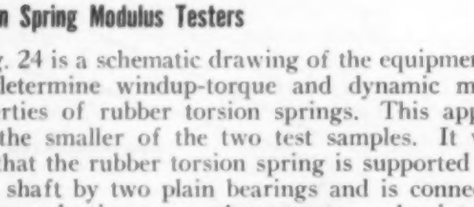

FIG. 24—Modulus tester (small springs).

FIG. 25—Modulus tester (small springs).

excited, a light-weight stylus fastened to the spring housing describes an arc on a piece of recording paper driven by a synchronous motor through a known gear reduction. If the spring is excited and a damping curve recorded, data are available to calculate the natural dynamic frequency of the spring and mass system.

Test equipment as outlined here is excellent for obtaining hysteresis data because the test piece functions as its own bearing and eliminates all chance for dry friction in the apparatus. The entire system can be enclosed in a constant temperature chamber and the temperature varied from —50° F. to +150° F. Fig. 25 is a photograph of the apparatus without the constant temperature chamber in place.

Fig. 26 is a photograph of a frame and loading device which will accommodate large torsion springs of various sizes. Modulus data can be obtained on this testing frame in much the same manner as the smaller machine previously described. No data secured with this machine are included in this paper.

Fatigue Test Apparatus

Accelerated fatigue tests of any type always present difficult problems. Whenever service conditions are exaggerated there is the constant uncertainty about

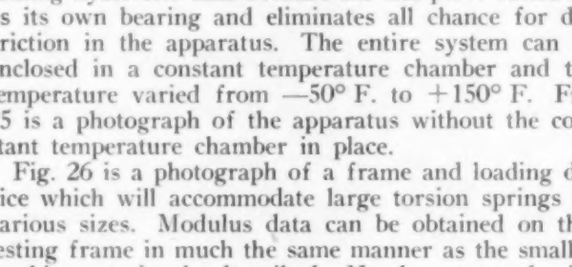

FIG. 26—Loading frame (large springs).

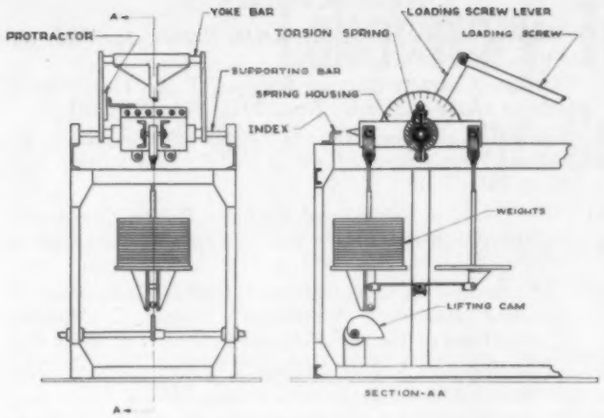

FIG. 27—Five place fatigue tester (large springs).

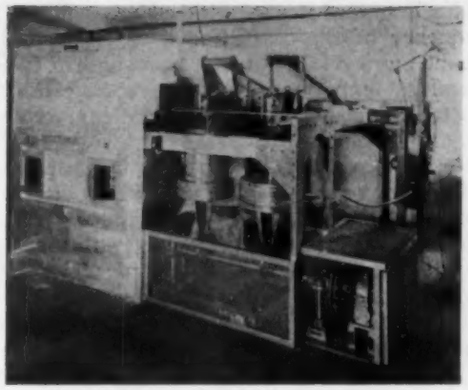

FIG. 28—Five place fatigue tester (large springs).

correlation between the exaggerated conditions and the long time service conditions. In the case of a rubber Torsilastic spring it is possible to accelerate fatigue test conditions in several ways, for example by increased frequency of flexing, increase of stress, increase of temperature, increase of stress cycle, or use of poor compounds.

Care must be exercised in exaggerating each one of these test conditions because if they are too far removed from actual service conditions the results do not correlate. For instance, the rate of flexing in rubber at elevated temperature not only accelerates creep but actually changes the modulus of the stock. Increasing the stress induces exaggerated strains causing stress concentrations which are not present in service conditions.

In the case of a fatigue test one always must make a decision as to whether the test will be set up on a constant stress, constant strain, or constant energy basis. The constant stress method of comparing compounds always favors a stiff stock while a constant strain will favor soft stocks. From this viewpoint the constant energy basis of comparison is the most ideal. However, a constant energy test is difficult to establish and it is difficult to maintain proper test conditions.

A compromise was made and the fatigue test data which are reported in this paper were obtained on a constant-load type testing machine. A further compromise was established for accelerating conditions by testing springs of various rubber compounds at different stresses at a temperature of 140° F., and with a constant amount of lift of the driving cam.

Fig. 27 shows a schematic drawing of such a testing machine. The torsion spring or test piece is held in a spring housing comprised primarily of two halves bolted together so that the amount of "radial compression" can be controlled. The spring housing has two arms upon which weight hangers are hung through self-aligning, anti-friction ball bearings. For practical reasons the weight hangers are guided to prevent their swinging. The spring shaft is keyed to two levers connected through a yoke bar to a loading screw.

An index point fixed to the frame of the machine establishes a reference point for locating the level position or null position for the spring housing. Torque is applied to the spring by adding weights to the front pan. This torque will stress the rubber spring, causing it to wind up, and the indicator on the spring housing will move below the index. The loading screw can then be tightened, turning the spring shaft in order to revolve the whole spring. The spring housing is thereby returned to its original level position.

In such a manner known values of torque can be applied to the spring, and the only friction in the system is that presented by the anti-friction bearing at the top and bottom of the weight hangers. The friction of these bearings may be neglected. The windup of the spring is indicated by the protractor and indicator placed on the spring housing and the loading screw lever, respectively.

The use of two weight pans makes it possible to add known torque producing masses to the system which do not effect the stress of the rubber, but will change the natural frequency of the system. This is desirable because the natural frequency should be held fairly constant from test to test.

The cam-rider located at the bottom of the lift pan is adjusted to engage the lifting cam. The cam lifts the weights or unwinds the springs by a known amount. When the cam-rider rolls off the edge of the cam the entire spring system, weights and weight pans oscillate freely until the cam again revolves and engages the cam-rider. For the purpose of this accelerated fatigue test the cam turned at 5 rpm and the cam and cam-rider were so adjusted that the spring was

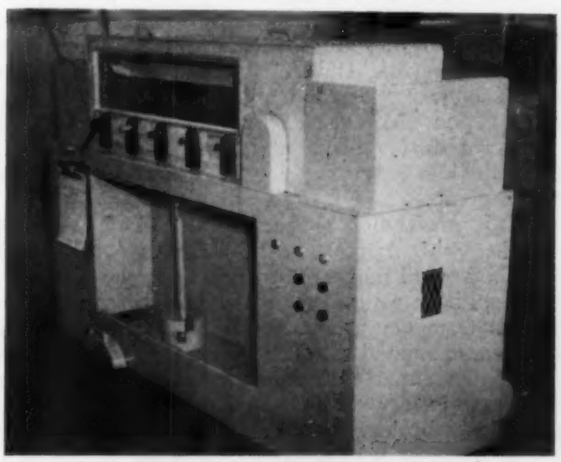

FIG. 29—Five place fatigue tester (small springs).

unwound 20° before it was released to oscillate freely. The frequency of the oscillating system was adjusted to be about one cycle per second or slightly faster. It was found by experience that the spring undergoes seven to ten damped cycles before the cam re-engages the oscillating system.

In order to expedite testing, the entire system is still oscillating at a reduced amplitude when the cam re-engages the cam-rider. Severe bouncing is sometimes encountered when the cam re-engages the cam rider because the amount of weight placed on the weight pan may vary from 300 to 1200 lbs. It was found necessary to install a relatively soft coupling between the camshaft and the drive unit.

Fig. 28 is a photograph of the actual machine; it shows the cam partially lifting the unit on the extreme right-hand side. The unit next to it is balanced at its null position. There are three additional, but similar, units enclosed in the steam-heated oven at the left side of the machine. The controls are shown at the far right-hand side of the machine.

Fig. 29 is a five position fatigue test machine which accommodates the smaller test piece. This tester is a constant stroke machine but is comparable to the previously described tester in all other respects. The springs are periodically adjusted to correct for creep, making it a constant load test.

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(2) "Fatigue Characteristics of Rubber," F. L. Yost, *Transactions of the A.S.M.E.,* Nov., 1943, Vol. 65, p. 881.

(3) Discussion of Paper No. (2) of this bibliography, J. H. Dillon, *Transactions of the A.S.M.E.,* Nov., 1943, Vol. 65, p. 881.

(4) "The Creep of Natural and Synthetic Rubber Compounds in Shear," Stuart H. Hahn and Ivan Gazdik, *India Rubber World,* Vol. 104, Feb., 1941, p. 51.

(5) "Effectiveness of Shear-Stressed Rubber Compounds in Isolating Machinery Vibrations," Baxter C. Madden, *Transactions of the A.S.M.E.,* Aug., 1943, Vol. 65, p. 617.

(6) "Vibration and Rubber Springs," Walter C. Keys, *Mechanical Engineering,* Vol. 64, March, 1942, p. 175.

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(9) "Rubber Springs—Shear Loading," J. F. Downie-Smith, *Journal of Applied Mechanics, Trans. A.S.M.E.,* Vol. 61, 1939, p. 159.

(10) "Polar Strain," C. W. Harris, private communication to the authors.

Operation of the Tire Manufacturing Industry in Argentina

THE tire industry in Argentina is operating on a highly accelerated production basis, according to a report recently issued by the U. S. Bureau of Foreign and Domestic Commerce. Although production has increased, as compared with prewar output, the supply is not as yet meeting the demand. Imports are needed to close the gap. During the war, as a stimulus to supplement the domestic production, import duties and internal revenue taxes were lifted on imports, and as yet these levies have not been reimposed.

Tire production increased steadily from its inception in 1931 until early in 1942, when scarcity of raw materials halted progress. In 1941 the industry produced in excess of domestic demand and brought about a net export position. Argentina's raw-materials position in the rubber industry being at lowest ebb for about 3 years created a heavy backlog of demand for transportation goods.

Domestic production plus imports no doubt supplied the market with more than 1,000,000 tire casings in 1946. The annual market absorption for the next 2 or 3 years has been estimated at 850,000 tire casings and a somewhat smaller number of inner tubes. Domestic production, estimated at 60,000 tire casings in November, 1946, is expected to increase steadily to about 70,000 per month by the middle of 1947. Roughly, this output may be broken down on a basis of one truck-tire casing to three passenger-car-tire casings, in line with the pattern of market demand.

A trade agreement between Argentina and Brazil allows Argentina to receive from Brazil 40,000 truck and bus and 40,000 passenger-car-tire casings, all with inner tubes, in 1947. A provision is also included for the receipt of sufficient tires and tubes, supplemental to domestic production, to satisfy the market demands for 1948 through 1951. This provision is contingent upon the ability of Brazilian industry to meet its domestic demand and furnish an exportable surplus. Comparative market prices must also be consistent.

The domestic tire industry buys its supply of rubber from the Government at a price appreciably higher than the prevailing world prices. Its tire casings are subject to internal revenue taxes and controlled prices. By contrast, imported tires are excluded from internal-revenue taxes and are sold on a free market.

It is reasonable to expect that Argentina will make such adjustments in prices of natural rubber, revenue taxes, and duties as will enable the domestic industry to meet competition from abroad when tire casings from other countries become available in greatly increased quantities.

Regardless of the ability of the Argentine tire industry to produce tires that will compete in quantity and quality with the imported tires, imports will continue heavy until the industry can compete also on a price basis. Even if import duties and internal-revenue taxes on imports are reinstated and crude rubber prices are reduced, the import market should be good during the early part of 1947 and the recession in the latter half of the year should be gradual.

Laboratory Testing of Rubber for Cut-Growth

By WILLIAM L. HOLT and ELLIS O. KNOX
National Bureau of Standards, Washington, D. C.

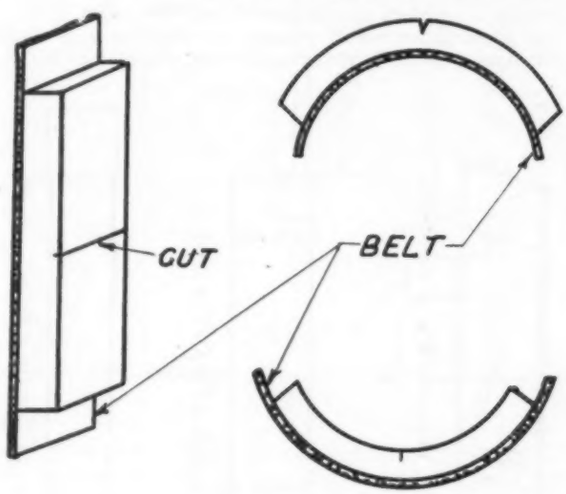
Thirteen methods which have been used in the laboratory by different investigators for measuring cut-growth resistance are described and compared. General conclusions as to the mechanism of cut-growth and the relative resistance of GR-S and natural rubber are given. The fact that the cut-growth resistance of GR-S is much affected by the testing temperature and by the degree of cure is illustrated by two graphs.

WHEN rubber is given an initial cut or other injury and then subjected to repeated strain there is a tendency for the cut or injury to "grow." This tendency is much more pronounced in GR-S than in natural rubber compounds. In fact, the difference is so great that many tests which may be applied satisfactorily to GR-S have little measurable effect on natural rubber.

A careful distinction should be made between flex cracking or initiation of a crack and cut-growth or continuation of a crack when started. In wheel-tests of tires in the laboratory it is difficult to set conditions to start spontaneous flex cracking, but if a small cut is made in the bottom of a non-skid groove, the cut may grow rapidly.

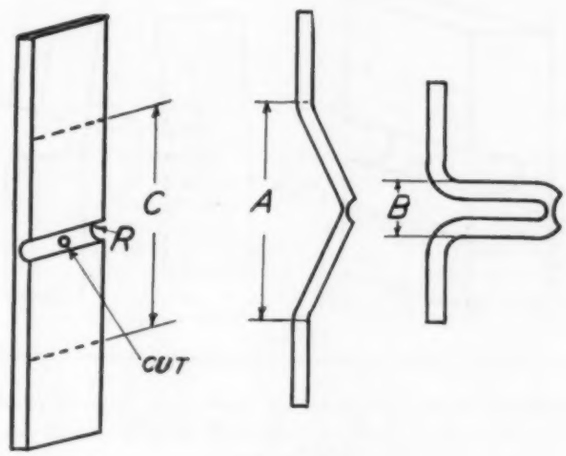
One method of testing tires on the road is to run

Fig. 1 (Methods 1 to 13)—Various test specimens and test methods used in measuring cut-growth. The sketches show the specimens as prepared and the approximate limits of distortions during a test.



Method 1

Method 1: Carlton and Reinbold, *India Rubber World,* Vol. 108, p. 141 (1943); *Rubber Chem. Tech.,* Vol. 16, p. 897 (1943).
Type of specimen: Molded with fabric backing.
Size: 4 x 1 x 0.275".
Cut: 0.040" deep made with razor blade.
Test temperature: Room and 180°F.
Speed: About 400 cycles per minute (300 tension, 100 compression).
Cure: Undercure to overcure.
Life ratio: Natural rubber/GR-S = 4/1 to perhaps 25/1.
This is ASTM test D430-40 Method C, DuPont belt flexing machine except for the thickness of the specimen and the cut.



Method 2

Method 2: ASTM D430-40 Method B and D813-44T.
Type of specimen: Molded with groove.
Size: 6 x 1 x ¼", A = 3", B = ¾", C = 3¼", R (rad) = 3/32".
Cut: No hole for D430-40, hole completely through with 0.050" needle for D813-44T.
Test temperature: As desired.
Speed: 300 cycles/min.
Cure: As desired.

Method 3: Breckley, *Rubber Age,* Vol. 53, p. 331 (1943); *Rubber Chem. Tech.,* Vol. 16, p. 901 (1943).
Specimen: Method 2 used except that cut is made with "pin tool" 0.025" diameter and 0.050" deep.
Test temperature: Room to 100°C.
Cure: Undercure to overcure.
Data given on the effect of compounding ingredients.

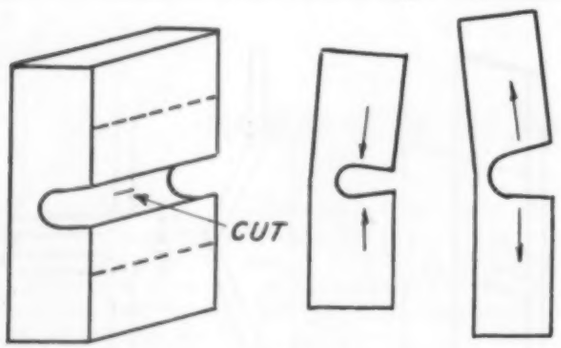
Fig. 1 (Continued)

Method 4: Schwartz, *India Rubber World*, Vol. 110, p. 412 (1944).
Specimen: Method 2 used except for different combinations of values for A. B, and C. Also, cut is 2 mm. long and is made with razor blade parallel to axis of groove.
Test temperature: Room.

Method 5: Vanderbilt Rubber Handbook (1942), p. 304.
Specimen: Method 2 used except A = C = 3½", B = 1¼", and speed = 375 cycles/min.
Radius R is given in handbook through error as 1/16".

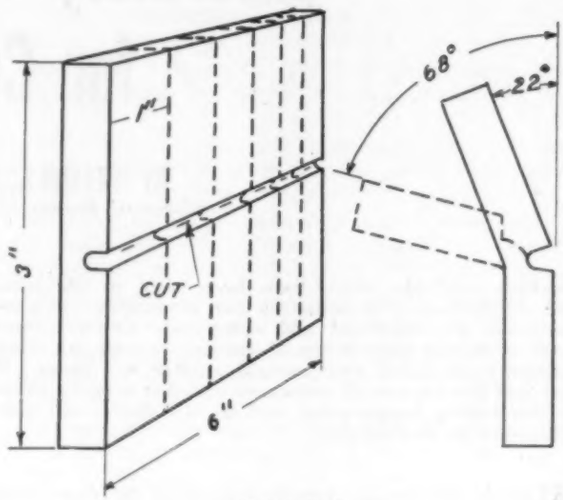
Method 6: Winn and Shelton, *Ind. Eng. Chem.*, Vol. 37, p. 67 (1945); *Rubber Chem. Tech.*, Vol. 18, p. 407 (1945).
Specimen: Method 2 used except cut consists of "nick 0.035" long" made with automatic lance. Also speed is 500 cycles/min.
Test temperature: 20° to 80°C.
Cure: Undercure to overcure.
Data given for tests in atmospheres of air and nitrogen.

Method 7: Unpublished Report of the National Bureau of Standards.
Specimen: Method 2 used except that cut is made with needle 0.025" diameter and speed was 625 cycles/min.
Test temperature: Room to 100°C.
Cure: Undercure to overcure.
Life ratio: Natural rubber/GR-S = up to several hundred/1.



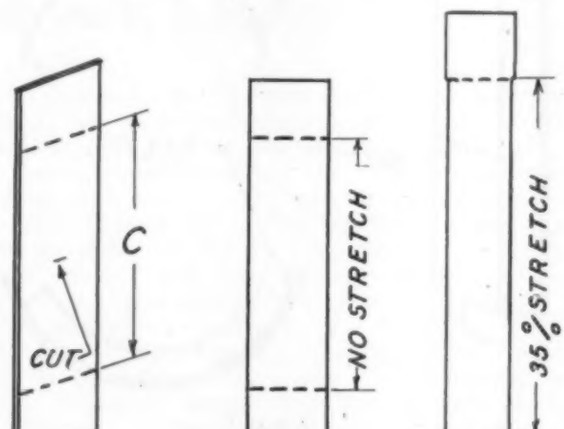
Method 8

Method 8: Prettyman, *Ind. Eng. Chem.*, Vol. 36, p. 29 (1944); *Rubber Chem. Tech.*, Vol. 17, p. 441 (1944).
Type of Specimen: Molded.
Size: 1¾ x 1⅜ x ½".
Cut (if used): 0.047" deep x 0.2" long.
Test temperature: 45° to 100°C. (due to build up).
Speed: 1160 cycles/min.
Cure: Undercure to overcure.
Life ratio: Natural rubber/GR-S = up to 280/1.
Tests with different degrees of distortion reported.



Method 9

Method 9: Vila, *Ind. Eng. Chem.*, Vol. 34, p. 1269 (1942); *Rubber Chem. Tech.*, Vol. 16, p. 184 (1943).
Type of Specimen: Molded with groove.
Size: 6 x 3 x ⅜" or 1 x 3 x ⅜".
Cut: Nicks made with razor blade in one or more places.
Test Temperature: Room.
Speed: 300 cycles/min.
Cure: Range of cures.
Results: Expressed as mils growth per/1000 cycles.
Test Methods are not of primary consideration in this paper. It deals principally with the effect of accelerators in GR-S.



Method 10

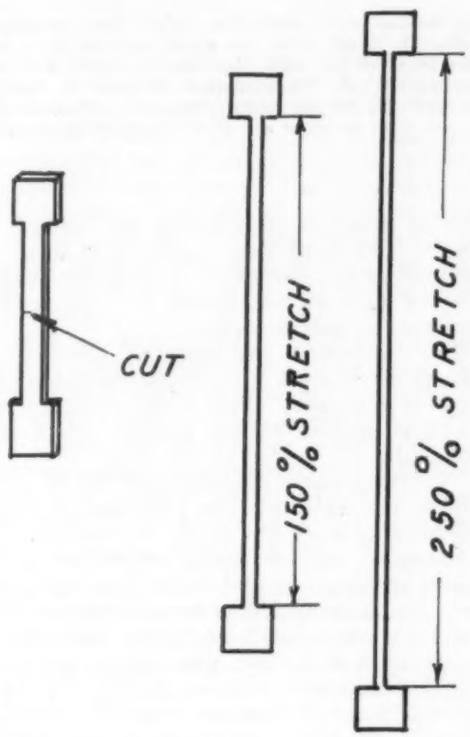
the first part of the test on gravel roads and the latter part on paved roads. Small accidental cuts or injuries produced on the gravel road have a chance to grow during the latter part of the test and may be used as a measure of the tendency toward cut-growth.

Methods of measuring the resistance to flex-cracking and to cut-growth in the laboratory were used to some extent previous to the advent of GR-S. For natural rubber, however, these phenomena were not serious causes of failure of rubber products. With GR-S, the general purpose rubber used in tire treads, means of preventing cut-growth or reducing the tendency toward cut-growth are major problems. Cut-growth is particularly serious in the treads of truck tires.

Laboratory tests for cut-growth are in most cases similar to those used for fatigue or flex-life of natural

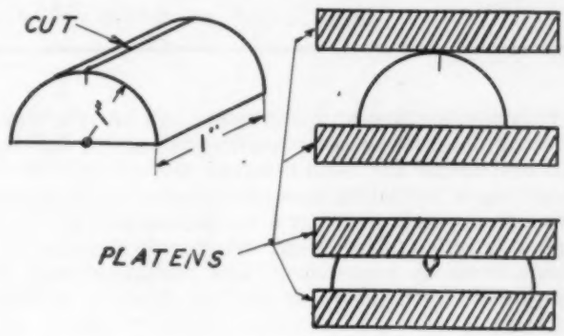
Fig. 1 (Continued)

Method 10: Unpublished Report of the National Bureau of Standards.
Type of specimen: Cut from sheet.
Size: 5 x 1 x 0.080" (approx.), C = 3¼".
Cut: Cut through with chisel ⅛" wide.
Test temperature: Room to 100°C.
Speed: 625 cycles/min.
Cure: Undercure to overcure.
Life ratio: Natural rubber/GR-S = 2/1 to 60/1.
This specimen may be cut from a tensile test sheet. The test was adapted from an unpublished report from the Goodyear Tire & Rubber Company.



Method 11

Method 11: The Carbon Reinforcement of (Buna S) GR-S, p. 123, published by the Columbian Carbon Company, New York (1943).
Type of specimen } : "T-50" specimen used.
Size }
Cut: Started with "sharp scalpel."
Test temperature: Room.
Speed: 375 cycles/min.
Cure: Undercure to overcure.
Life ratio: Natural rubber/GR-S = several hundred/1.



Method 12

Method 12: Trepp, Ward, and Chaney, United Gas Improvemen Co., unpublished report.
Type of specimen: Molded.
Size: 1 x 1 x 2" diam.
Cut: Knife cut 8 to 9 mm deep.
Test temperature: Platens heated to 135°F.
Speed: 10 min. per cycle.
Cure: Undercure to overcure.
Life ratio: Natural rubber/GR-S = "very high."
This test is referred to as compression tear test for susceptibility to cut-growth.

Method 13: Fielding, *Ind. Eng. Chem.*, Vol. 35, p. 1259 (1943); *Rubber Chem. Tech.*, Vol. 17, p. 398 (1944).
Specimen: "Ring shaped."
Speed: 550 cycles/min.
Data are given for natural rubber, GR-S, and GR-I under different degrees of distortion. Test methods are not of primary consideration in this paper. The author suggests Method 2 as a successful type of test for cut-growth.

rubber, except for the initial cut. Because GR-S as made at the present time is so much inferior to natural rubber in its resistance to cut-growth, precise means of measuring the property have been relatively unimportant. However, the many new synthetic rubbers which are emerging and advances in the art of making GR-S make it desirable to standardize procedures used in evaluating cut-growth resistance.

In Fig. 1 the principal ways which have been reported for measuring cut-growth are described briefly and illustrated by sketches. In all cases, with the possible exception of Method 12, cut-growth is caused by repeated stresses at the ends of the initial cut. These stresses are produced by stretching or bending, alternated with a reduction or elimination of stretch or with compression.

The conclusions reached by the different methods are similar, but when numerical comparisons are made between different compounds of GR-S, between different synthetic rubbers, or between natural and synthetic rubbers, wide discrepancies exist. For instance, the relative rate of cut-growth of natural rubber and GR-S is given by several authors and listed in the figure as the life ratio. The most unfavorable "score" for GR-S is several hundred to one. Other figures are 60 to 1, 4 to 1, and 2 to 1. Probably any of these can be justified if the right conditions are selected.

In Figs. 2 and 3 typical results are given on three cures of a GR-S compound tested at four different temperatures by Methods 10 and 7 respectively. Experience indicates that similar results would be expected by the other methods outlined in Fig. 1. Different lots of GR-S from widely different sources gave similar results.

The cut-growth resistance of undercured GR-S at room temperatures is almost as good as that of natural rubber. These conditions account for the ratios of 2 to 1, and 4 to 1. Normal or overcured GR-S at the higher temperatures account for the ratios of several hundred to one.

TABLE I—COMPOUND USED FOR CUT-GROWTH TESTS ILLUSTRATED IN FIGURES 2 AND 3.

Ingredients	*Parts by Weight*
GR-S	100.0
Carbon Black (EPC)	50.0
Zinc Oxide	5.0
Softener (BRT No. 7)	5.0
Sulfur	2.0
Mercaptobenzothiazole	1.5
Total	163.5

It is obvious that no one number can be safely used to show the relative cut-growth resistance of different rubbers unless the conditions of test are given. It would seem logical to base most comparisons on well cured compounds tested at a temperature of 75° C. or higher in order to bring out cut-growth characteristics which show up in service. The compound used for cut-growth tests illustrated in Figs. 2 and 3 is shown in Table I.

General Conclusions Based on All Methods

In spite of the differences in the methods employed for measuring cut-growth several general conclusions can be drawn from the data available, as follows:

1. Cut-growth takes place when the portions of the rubber at the ends of a cut or injury are subjected to tensile stresses. In laboratory tests these stresses may be produced either by stretching the specimen or by bending or compressing it. One should distinguish between crack initiation and crack growth. If the surface of a GR-S specimen is not marred, the resistance to cracking may approach that of natural rubber, but if the surface is injured the tendency of the injury to grow or spread is much greater for GR-S than for natural rubber.

2. The cut-growth resistance of GR-S is affected greatly by the state of cure. Undercures have superior cut-growth resistance. This same statement might be made about natural rubber but the effect is not as pronounced.

3. The cut-growth resistance of GR-S is affected greatly by temperature. The resistance to cut-growth, for instance, is much less at 75° C. than at 25° C.

4. Synthetic rubbers which crystallize on stretching such as neoprene and butyl have cut-growth resistance approaching that of natural rubber. The poor resistance to cut-growth of GR-S and Buna N has been attributed to the fact that they do not crystallize. (See reference under Method 13, Fig. 1.) In making cut-growth tests of rubbers that do crystallize, the severity of the test is increased if the strain in the specimen passes through zero during a flexing cycle. With rubbers that do not crystallize, such as GR-S, the passing through zero strain seems to be of no particular significance.

5. Different carbon blacks, softeners, accelerators, etc., have been used with some success in improving the resistance of GR-S to cut-growth but compounding does not produce outstanding improvements.

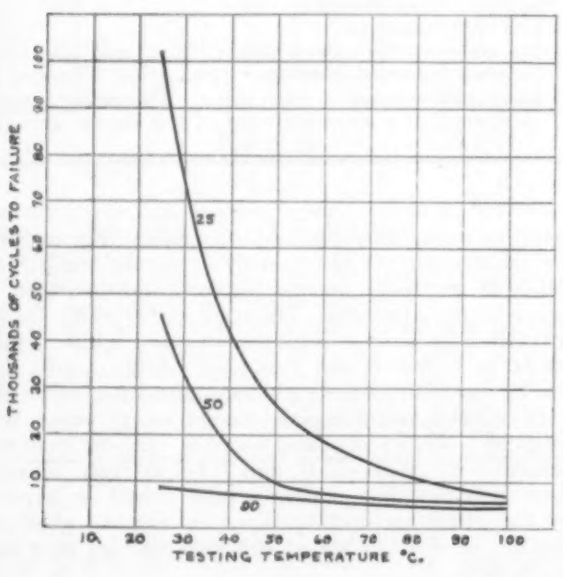


FIG. 2—Cut-growth test of a typical tread compound by Method 10. Results show the cycles required for a 1/8" cut to grow completely across the 1" dimension of the specimen. Numerals on curves show minutes cure at 292° F. The compound is shown in Table I. A corresponding natural rubber compound withstands 100,000 or more cycles at any of the temperatures shown.

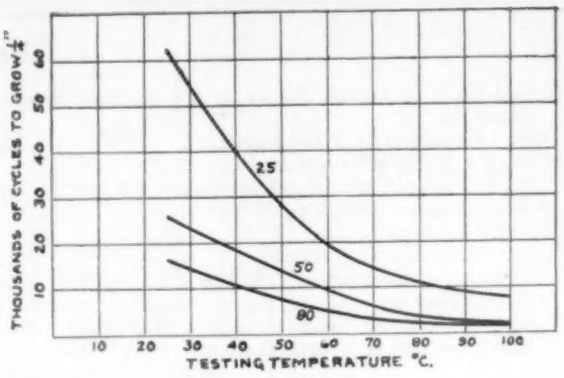


FIG. 3—Cut-growth test of a typical tread compound by Method 7. Results show the cycles required for a hole to grow to a cut 1/4" long. Numerals on curves show minutes cure at 292° F. The compound is shown in Table I. A corresponding natural rubber compound withstands 100,000 or more cycles at any of the temperatures shown.

Summary

Of the several methods described for measuring cut-growth, Methods 10 and 11 have the advantage that specimens can be cut from sheet material. Method 8 perhaps reproduces the distortion of tire treads best.

There seems to be no particular reason for the many variations of Method 2, which is an A.S.T.M. standard.

It is pointed out in several of the references that the ability of a rubber to withstand repeated flexing should be carefully distinguished from its ability to resist cut-growth after a cut is started.

Tests for cut-growth resistance should extend to relatively high temperatures and preferably should cover a series of cures.

RECENT ADVANCES IN THE PHYSICS AND CHEMISTRY OF RUBBER

5—The Oxidation of Rubber: A Kinetic Approach

By J. L. BOLLAND

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AN examination of the oxidation products obtained from a series of simple olefins and rubber itself have provided much information as to the course the oxidation follows. Two earlier papers *(1, 2)* in the present series have given some account of analytical investigations of this nature. The general conclusion drawn is that for a range of non-conjugated olefins the major site of reactivity is not the double bonds but the neighboring (or α-) methylene groups; thus the main products in the early stages of oxidation are normally α-hydroperoxides.

The yield of these products does however depend markedly on the structure of the olefin: when the oxidation of natural rubber is examined *(3, 4)* it becomes apparent that in addition to hydroperoxides, a variety of other oxygenated groups are introduced into the hydrocarbon, either independently of the hydroperoxides, or as a result of their farther reactions. On the other hand a typical 1-4 diene like ethyl linoleate,

$$CH_3(CH_2)_4CH = CH—CH_2—CH=CH—(CH_2)_7.COO\ Et.$$

gives quantitative yields of hydroperoxide during the early stages of its interaction with molecular oxygen. We are therefore justified in representing the complete chemistry of this particular system in the very simple form

$$RH + O_2 \rightarrow ROOH \qquad (1)$$

(where R refers to the residue obtained by removing a hydrogen atom from an α-methylenic group in an ethyl linoleate molecule).

Now this equation is a shorthand expression which gives the identity and relative weights of reactants required to give the indicated final product. It is not, however, to be taken as an indication of the way in which the individual molecules of ROOH are formed from individual molecules of oxygen and RH. No decision as to the mechanism, by which the final result expressed by (1) does actually happen, can be made on the basis of the analytical approach; we have available, however, a method of tackling this particular aspect of the problem, known as Kinetic Analysis. It is our purpose here to outline its application and indicate some of the results obtained.

Thermal Oxidation of Ethyl Linoleate

In the first instance, we have examined the thermal oxidation of ethyl linoleate, in view of the apparent simplicity of its chemistry. The general experimental method consists of finding a reliable method of measuring the rate of the reaction to be studied and then determining the rate over as wide a range of experimental conditions as possible. Here the experimental arrangement is to shake small samples of linoleate in presence of oxygen at 35° to 65°C. and measure volumetrically the rate at which the oxygen is absorbed. The oxidation is then found to follow the course indicated in Fig. 1.

Using even the most carefully purified linoleate we find a definite initial rate of oxidation, which increases linearly with the extent of oxidation or (since in this range the yield of hydroperoxide is quantitative) linoleate hydroperoxide concentration, [ROOH], until about 0.2 molecules oxygen have been absorbed for every linoleate molecule originally present; thereafter departure from linearity becomes appreciable. This behavior is characteristic of the so-called autocatalytic type of reaction, in which the reaction products accelerate the rate of reaction. We must accordingly expect that linoleate hydroperoxide plays an important role in the mechanism of the oxidation.

Other conditions under which the oxidation is carried out—pressure of oxygen, concentration of linoleate and temperature—may be varied one at a time in systematic fashion, so that finally it is possible to forecast what the rate of oxidation will be under any set of

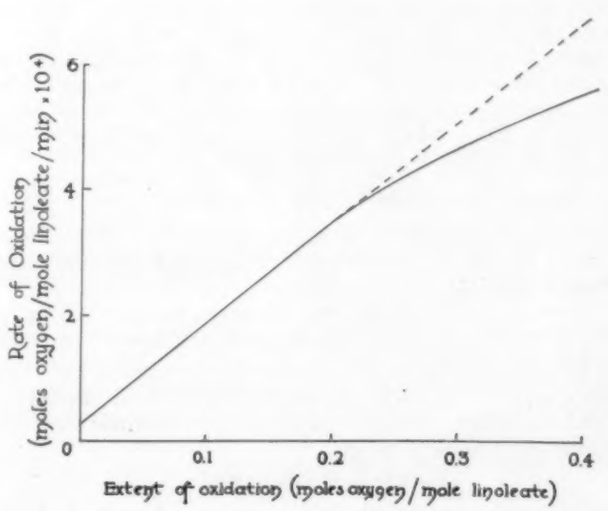


Figure 1.

Note: This paper is one of a series based on lectures delivered during 1945-46 by members of the staff of the British Rubber Producers' Research Association at Newton Heath Technical School, Manchester, or before the Leicester Section of the Institution of the Rubber Industry, or under the auspices of the Extra Mural Department of the University of Birmingham.

conditions of peroxide ([ROOH]) and linoleate ([RH]) concentrations, oxygen pressure and temperature. Thus the rate of oxidation of ethyl linoleate can be conveniently expressed by

$$\text{Rate} = C.\ [ROOH]\ [RH]\ \frac{C'\ [O_2]}{1 + C'[O_2]} \qquad (2)$$

where C and C' are constants which depend only on the temperature.

As will appear later, the mechanism of oxidation reactions is complex in that it involves a series or chain of separate elementary chemical processes, which are very closely interlinked one with another: each reaction depends on the prior occurrence of an earlier reaction, while its occurrence in turn produces the products necessary for a third. We may express the rate of each elementary reaction in terms of the concentrations of the reactants, say A and B, as k [A] [B] where k is a characteristic constant normally known as the reaction velocity coefficient. It is to be expected that the characteristic features of these expressions for the rate of the various elementary reactions would each contribute something to the make-up of the relation—like equation (2)—which summarizes the kinetic features of the complete over-all reaction.

Inverting the process, it becomes reasonable that given such a general rate equation, it should be possible to identify some or all of the elementary reactions concerned. There is a standard way of carrying out this process quantitatively—known as the Stationary State Method—for details of which reference is made to standard text books on kinetic analysis *(5)*. In the case of the oxidation of ethyl linoleate application of the method leads to the conclusion that there is only one reaction scheme which will lead to an experimental rate equation of the form of (2) and at the same time be consistent with chemical and spectroscopic evidence *(6)* as to the nature of the hydroperoxide formed.

This unique solution is a reaction of the chain type; formally all chain mechanisms include three distinct components: (a) initiation or chain-starting, (b) chain propagation and (c) chain-termination.

Initiation: In this case the major chain starting reaction is identified with the thermal decomposition of linoleate hydroperoxide molecules, which results in the formation of free radicals. The precise way in which this occurs has not yet been determined, but we can say that the decomposition involves pairs of hydroperoxide molecules and that the important radicals are either of the type R— (i.e., a linoleate molecule with an α-methylenic hydrogen atom removed) or RO_2— (i.e., an R— radical with two oxygen atoms attached R-O-O- in the α-methylenic position):

$$2ROOH \rightarrow R\text{— or } RO_2\text{—} \qquad (R1)$$

Chain-Propagation: With the production of such reactive species a succession of very rapid reactions becomes possible:

$$R\text{—} + O_2 \rightarrow RO_2\text{—} \qquad (R2)$$
$$RO_2\text{—} + RH \rightarrow ROOH + R\text{—} \qquad (R3)$$

The essential features of these two reactions are that they convert one type of radical (or "chain carrier") into the other, and that each pair of reactions has the resultant chemical effect

$$RH + O_2 \rightarrow ROOH$$

and yet regenerates the original type of radical chain carrier.

Chain-Termination: Reactions (R2) and (R3) thus occur alternately until they are finally brought to a stop by some additional (termination) process which converts the radicals to products which cannot continue the chain propagation processes. In this case chains are terminated by interaction between two chain carriers. Of the three possibilities

$$\left.\begin{array}{l} R\text{—} + R\text{—} \rightarrow \\ R\text{—} + RO_2\text{—} \rightarrow \\ RO_2\text{—} + RO_2\text{—} \rightarrow \end{array}\right\} \text{ Stable products} \qquad \begin{array}{l}(R4)\\(R5)\\(R6)\end{array}$$

reaction (R6) is of overwhelming importance at all but very low oxygen pressures. This arises from the fact that given equal concentrations of reactants, propagation reaction (R2) occurs very much more readily than (R3) and hence the average life time of an R— radical is much smaller than that of an RO_2— radical. The resulting preponderance of RO_2—radicals favors reaction (R6) to the exclusion of (R4) and even (R5)—except when the oxygen pressure (and therefore concentration) is sufficiently low to redress the balance and slow down (R2) to a rate comparable with that of (R3).

It is to be stressed that reactions (R2) and (R3) alternate on the average about 100 times before the oxidation chain is terminated by reaction (R6). This implies that the main oxidation product will be that resulting from (R2) and (R3)—namely, linoleate hydroperoxide—while the products from the initiation and termination steps will be formed in relatively trivial amounts.

Initial Stages of Oxidation

At the commencement of oxidation of peroxide-free ethyl linoleate, peroxide decomposition is not the main chain-starting process; so long as the peroxide content remains small the majority of the chains are started by direct interaction between oxygen and the olefin, though the propagation and termination steps remain just as before. Kinetic measurements on which these findings are based do not allow identification of the chemistry of the reaction; only two possibilities are, however, apparent:

$$O_2 + -CH_2-CH=CH-CH_2- \rightarrow -CH_2-\underset{\displaystyle O-O-}{\overset{|}{CH}}-CH-CH_2- \qquad (R8)$$

or

$$\rightarrow -CH_2-CH=\underset{\displaystyle +\ -OOH}{\overset{|}{CH}}-CH- \qquad (R9)$$

In each case two radical ends are formed which correspond, at least formally, to RO_2— and R—. As oxidation proceeds and the peroxide concentration rises, the initiation step (R1) becomes of greater relative importance, and the autocatalytic nature of the oxidation becomes inevitable.

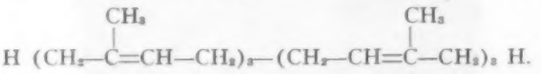
Oxidation of Other Olefins

Having established in detail the oxidation mechanism for an olefin, which behaves in a straightforward manner, the next step is to enquire to what extent these characteristics appear in the oxidation of olefins in general, with however particular reference to that of polyisoprenic systems.

Examination of the thermal oxidation of methyl oleate—taken as a convenient example of a mono-olefin

—shows that the mechanism is precisely similar to that for ethyl linoleate. An important quantitative difference may however be noted: the reaction RO_2— + RH → ROOH + R— occurs much more easily if RH represents ethyl linoleate rather than methyl oleate. This arises from the fact that in the former case the R— radical produced by the reaction is much more stable (and therefore introduces additional 'driving force' to the reaction) than the corresponding oleate radical, in virtue of its much greater resonance energy.* As this difference leads to a chain length about ten times smaller for oleate than for linoleate (under identical conditions of chain initiation) it is obvious that the resonance possibilities of the R— radical is a factor of some importance in the rate of olefinic oxidation in general.

In passing to a polyisoprene two fresh structural features are introduced: the double bonds are now disposed differently (with two methylene groups separating neighboring double bonds) and each double bond is now tri- instead of di-substituted. It is to be expected that these two structural factors will have some influence on the characteristics of oxidation. Squalene, which is essentially a six-membered polyisoprene, serves as a suitable example for experimental study:



It may be shown by kinetic methods that *formally* the propagation and termination reactions in this case also are represented by reactions (R2)—(R6); thus reaction (R2) still involves an oxygen molecule and a radical of type R— (i.e., with the free valence on a carbon atom) and reaction (R3) an olefin molecule and a radical of type R-O-O-.

Examination of the oxidation products, however, shows at once that *chemically* reactions (R2) and (R3) —which once again determine the identity of about 99% of the products, since the chain length is again of the order of 100—must show important differences from the formulation for the linoleate case, where the site of reactivity was invariably at the α-methylenic groups.

Thus it is found that even from the early stages of oxidation only some 50% of the oxygen reacted is in the form of hydroperoxide. The possibility that intra- or intermolecular bridge-type peroxides—which are not sensitive to the analytical reagents for hydroperoxides —account for the remainder of the combined oxygen has been suggested *(8)*.

This situation exemplifies the limitations to the use of kinetic analysis: it is normally possible to identify the general form of each elementary reaction and to decide what "finished" molecules (e.g., O_2 and RH) are taking part, but in order to assign structures to the transient species involved (such as radicals), and to fill in the chemical details of the path each reaction follows, it is necessary to take into account all available information as to the chemical identity of the final reaction products. The kinetic and analytical approaches to the problem are thus quite complementary; a well-balanced enquiry into the course of any reaction must therefore include investigations of both types.

* Bateman has discussed this effect in his contribution to the present series *(7)*.

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(6) Bolland and Koch, *J.C.S.*, p. 445 (1945).
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Protection of Workers from Organic Solvents

ALTHOUGH most workers will not knowingly drink an organic solvent, protection from this possible hazard should be a plank in industrial safety platforms. For when solvents are taken internally, they may cause permanent damage to tissues and organs and, in severe cases, death may result.

Solvents may be swallowed by intent or by accident. The story is told of a worker who heard someone describe a certain solvent as being "toxic." The term sounded pleasantly similar to "intoxicating" whereupon the man decided he would sample the liquid, which he did with fatal results. If a worker is informed that swallowing chemicals is dangerous and that solvents are no exception to this rule, it is not likely that he will deliberately violate it.

Accidents, however, can arise from a number of circumstances. A case in point is that of a carpenter who was quietly drinking liquor in the dark. When he reached for the liquor bottle, after having set it down on a table, his fingers closed about a bottle of solvent placed on the same table. He drank some and died in about ten days. In another instance, a man came into a shop to see a pail of liquid, which he thought was water, standing open on a bench. He swallowed a dipperful before he realized it tasted peculiar. Fortunately, he immediately vomited and was none the worse for his experience.

All vessels or containers of solvent should be clearly marked and they should be kept out of reach of visitors and workers from other departments who may be passing through rooms in which solvent operations are performed. When not in use, containers of solvents should be properly stored.

A doctor should be called at once if anyone swallows a solvent, even if no symptoms of discomfort or poisoning are immediately evident. Solvents may have a delayed effect. First aid measures are limited to inducing vomiting, so as to remove the solvent from the body. Some common emetics are mustard water, lukewarm salty water, and soapy water. While waiting for the arrival of the doctor, the accident victim should lie quiet in a well ventilated atmosphere.

Safety Research Institute

New Voit Rubber Production Set-Up Utilizes Radiant Drying Apparatus

By R. D. HOLMAN

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NEW equipment for drying and curing rubber-covered athletic equipment on a continuous, production line basis, has now been installed at the plant of the W. J. Voit Rubber Corp. The equipment will be used in processing the rubber bladders and coverings which are used in the company's line of footballs, basket balls, and other balls which require rubber bladders.

The equipment, which was specially designed, was developed and installed under the supervision of the Research Department of Voit Rubber. Radically new in design, the unit is equipped with a radiant drying furnace section which utilizes 90 all-ceramic cup burners and burns a mixture of accurately proportioned gas and air.

The equipment was designed to fulfill the need for speedier production, to conserve already restricted plant floor space, and for economy of operation. The new furnace unit which has filled this triple need functions as a single piece of equipment made up of four essential sections: Conveyors, Radiant drying section, Convection curing section, and Forced-air cooling section.

Two types of conveyors are used—roller and zig-zag. Two sections of conventional roller-type conveyors

FIG. 1—Molds are automatically picked up from a roller conveyor and carried through the radiant drying section by a zig-zag overhead conveyor. A mold can be seen entering the radiant drying section at top center.

FIG. 2—View of the gas-air combustion controller which supplies accurately-proportioned gas-air fuel mixture to the radiant firing chamber.

are used for loading and unloading the molds. The bladders in freshly loaded molds are inflated to 50 lbs. pressure and the molds placed on one section of the roller conveyor (Fig. 1) which automatically lifts and attaches the mold to an overhead zig-zag conveyor which carries it up and through the radiant drying section which is suspended from the ceiling. This same conveyor then transports the molds through the convection curing section. Emerging from the curing section, molds continue on to the forced-air cooling, or quench, section and finally complete the cycle by being transferred to the second section of roller conveyor which automatically lifts and detaches them from the overhead line.

Speed of Conveyor Adjustable

An automatic fuel shut-off is geared to the speed of the overhead conveyor; in case of mechanical failure or slow-down of the conveyor, fuel is instantly cut off. The entire 150 feet of overhead conveyor can be adjusted to travel at speeds ranging from three to nine feet per minute.

The radiant drying section has two basic parts, the first of these being a gas combustion controller (Fig. 2) which accurately proportions a definite air ratio with natural gas before delivering it to the burning chamber. This combustion controller draws fresh air from the atmosphere and gas directly from the main through proportioning valves that are adjusted to give the perfect mixture. A compressor boosts up the pressure of this mixture, then forces it to the burning chamber.

Construction of Drying Chamber

The radiant drying chamber, or furnace, itself, is a battery of ninety individually controlled, all-ceramic cup burners (Fig. 3). Five banks of eighteen burners each form a circular tunnel through which the molds carrying the bladders are channeled. Molds are in this drying chamber for approximately 48 seconds. The temperature maintained within the chamber is approximately 570° F.

The problem of burners which could be brought to this temperature almost instantly was solved by using specially designed all-ceramic burners. With burners of this type it is possible to get large heat releases in small burner concavities, in a minimum time, by utilizing the insulation and refractory quality of ceramics. These burners make possible the use of the carbureted gas-air mixture at higher than normal temperatures and when heated to incandescence, give off even, blast-free, radiant heat. The almost instantaneous heat which these burners give off eliminates the necessity for any pre-heating or warm-up period.

Each of the five banks of eighteen burners is lighted by an individually controlled, stainless steel, pilot bar burner, connected with a single bunsen burner at one end of the chamber and a Flame-O-Trole at the other. Molds rotate constantly while passing through the radiant heat zone by a rack and pinion which is forced against a guide rail.

FIG. 3—Burner arrangement of one bank of the gas-fired radiant heating chamber. There are ninety all-ceramic cup burners arranged in five banks of 18 burners each.

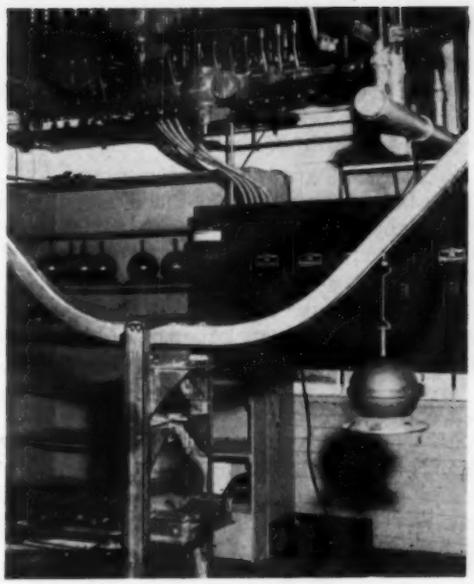


FIG. 4—The overhead conveyor returns molds to a roller conveyor where they are automatically lifted off and made ready for reloading. The specially-designed molds weigh approximately 8 pounds and are made of 16-gauge steel.

After emerging from the radiant zone the conveyor carrying the molds drops about four and one-half feet to enter the convection curing section. Heat for this convection zone is produced by drawing of products of combustion and xecess heat from a radiant firing chamber by means of a slight, partial vacuum, channeling it to a tempering chamber where it is mixed with clear air, re-heated and forced into the convection furnace section. Temperature in this section is kept at approximately 350° F. Molds are subjected to this temperature for about ten minutes. Function of this convection section is to allow rubber within the molds to cure under controlled temperatures.

The fourth component of this production-line drying equipment is a cooling chamber. A fan draws fresh air from the atmosphere and circulates it throughout the cooling zone. Molds progress through this section in approximately ten minutes. Purpose of the cool air "quench" is to keep the air pressure within the bladder constant thus minimizing the possibility of blisters, due to liberated gases when chemical changes take place in the rubber itself. This air quench also cools molds so that the operators can immediately handle and reload them. Leaving the cooling section the molds return to the operator (Fig. 4), are reloaded and begin the complete drying, curing and cooling cycle again.

Briefly, the outstanding advantages of this equipment can be summarized as follows:

(1) A saving in valuable factory floor space is effected since the entire drying, curing and cooling sections, plus the complete conveyor system, occupy only eighty-three square feet of floor space (Fig. 5).

(2) The entire operation is completely automatic which eliminates much of the need for skilled work-

men and requires but two men to keep a steady flow of work in progress.

(3.) With this new gas equipment it is now possible to have both drying and curing done on a continuous line basis while maintaining a production of five thousand pieces per eight hour shift.

(4.) Since molds are cool when returned for reloading, rejects have been greatly reduced because chemical changes in the rubber itself now take place under controlled temperatures which minimizes the chances for blisters to form.

(5.) Fuel costs have proved exceptionally low, costing but ten cents per hour of operation.

Although the company now has a tremendous backlog of orders, the management realizes that business will return to a competitive basis. To meet this future challenge, Voit Rubber is arming its plant with new equipment, and applying many recently developed techniques and methods to all production problems. The company is sparing no effort or expense to maintain its established leadership in the rubber sporting goods field.

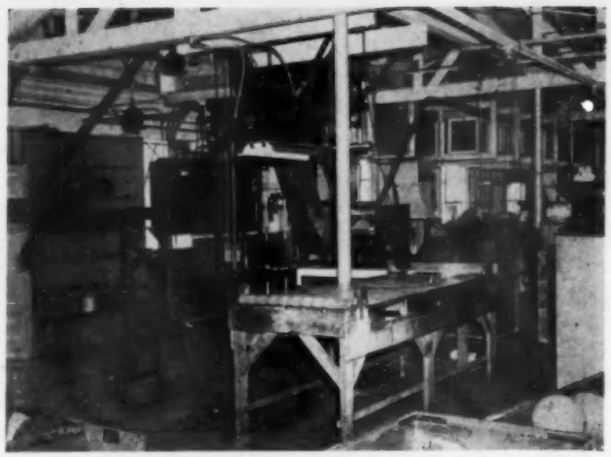


FIG. 5—Over-all view of the new Voit Rubber installation. At the upper left molds can be seen entering the radiant heating section. The control board is also visible in the background.

Use of Lignin for the Reinforcement of Rubber

DEVELOPMENT of new lightweight rubbers as tough and strong as heavier types by using lignin, the waste material of the paper industry, as a reinforcing pigment, and the production of bright-colored rubber articles as durable as those of black rubber by utilizing the same material, was covered in a paper entitled "Lignin for Reinforcing Rubber," delivered before the Division of Rubber Chemistry, A.C.S., at the meeting held in Chicago last September. In a new process described in the paper, lignin is mixed with either natural or synthetic rubber in latex form so that it is coprecipitated or coagulated with the rubber, forming a material ready for processing. A comprehensive abstract of the paper, presented by J. J. Keilen and A. Pollak, of the West Virginia Pulp & Paper Co., Charleston, S. C., follows herewith:

Rubber articles strengthened and toughened with lignin reveal unusual properties. One of these is light weight. Lignin is only 72 percent as heavy as carbon black, the pigment most widely used for reinforcing rubber. Used in rubber tires, lignin could save approximately seven percent of the weight of the tire. In other rubber goods where more pigments, heavier than carbon black, are used, the saving in weight is considerably more. Thus, shoe soles or heels are 35 percent lighter when lignin is used.

Lignin also offers another advantage, long sought by the rubber industry—light, bright-colored articles that are as tough and strong as those of black rubber. Light colors are possible because lignin has itself a comparatively weak tinting power. Its natural dark brown color fades out on blending with minor proportions of white pigments and colors. The small amounts used do not impair the strength or toughness of the rubber except where near-white shades are desired.

Lignon-reinforced rubbers also provide advantages to the rubber converter. One of the most expensive operations in converting raw rubber to the finished article is the milling process. This involves the so-called breakdown of the rubber and the incorporation of reinforcing pigment. Lignin-coprecipitated rubber requires only one-fifth the breakdown time and the time for mixing pigment is eliminated entirely.

Lignin can serve a dual role in coprecipitation processes for other reinforcing pigments. It may be modified to act as a dispersing agent for other pigments to prepare them for coprecipitation. The development of otherwise desirable coprecipitation processes has been held up for lack of a suitable dispersing agent. Heretofore, the difficulty has been that pigments required considerable amounts of dispersants. Aside from their high cost, their presence interfered with the coprecipitation, and residual quantities in the resulting rubber impaired its quality. The use of lignin as dispersant has the considerable merit that it actually aids coprecipitation and that after coprecipitation the lignin remains to act as a reinforcing pigment.

This process of reinforcing with lignin can be applied to any rubber which occurs in latex form. Latex is an emulsion of tiny globules of rubber in a watery fluid. Natural rubber originates as a sap from rubber trees and this is also a latex. Solid rubber is made by consolidating the globules in latex, usually by chemical treatments. In using lignin an alkaline solution is first made and this is then mixed with latex in the desired proportions. The lignin and rubber are then precipitated together. This coprecipitate, or crumb, is then filtered and dried. The principal change in equipment over that now in use is the type of filters. When suitable filters are installed, their use also offers other manufacturing advantages.

The tensile strength of lignin-reinforced rubber compares favorably with that of rubbers containing the best reinforcing pigments known. At loadings higher than normal lignin provides higher tensile strengths than any other material tested.

Editorials . . . . . .

Pending Legislation

AS THIS is being written legislative action is pending on the fate of controls over the rubber manufacturing industry and that of the importation of natural rubber. Hearings have already been held on two bills proposed in the House of Representatives and another has been introduced in the Senate. The two House measures are the Arends Bill and the Crawford Bill, the major difference between them being that the former asks for continuation of controls beyond March 31 on both allocation and public purchase of rubber, while the latter would extend allocation controls only, thus opening a free market on rubber purchases. The Senate bill would extend all controls until June 30 of this year.

At this stage it seems quite likely that the Crawford Bill will be reported out favorably to the House by the subcommittee of the House Armed Services Committee which conducted the public hearings, as reported elsewhere in this issue. Members of the subcommittee are wrestling with the problem whether specification controls on rubber usage will be sufficient to sustain the synthetic rubber industry or whether imported stocks should be allocated among users until long-term legislation is finally adopted. The term "allocations" is understood to be bothering some of these legislators, and meetings are currently being held with representatives of various government agencies to iron out the difficulties and determine proper precautions to protect both the small and large rubber manufacturers.

The effect of the Crawford Bill would be to end exclusive public purchase of natural rubber on March 31 but would keep in force an allocation (and specification) system until permanent rubber legislation is enacted. Such legislation is of course, in turn, dependent upon the adoption of a national rubber policy, particularly where the synthetic rubber plants are concerned. That this situation is occupying the attention of the White House was recently indicated by Representative Sam Rayburn, Democrat minority leader in the House, who further stated that a special message on the subject would be presented to Congress by President Truman shortly. Mr. Truman, incidentally, recently stated that the maintenance of synthetic rubber plants in a standby condition was essential to national security.

The present situation, however, is still intense, insofar as the rubber manufacturing industry is concerned. In the Senate, an early study is expected to be made of the bill introduced by Senator Bricker to continue all rubber controls until June 30. With time running short, however, the Senate may go along with the Crawford Bill, if it is approved by the House. However, a Senate move to amend the Crawford Bill, or efforts to press for the Bricker Bill, might easily postpone action until after March 31, with the result that conditions in the industry would be most unstable for a short period. Unless extended, allocation controls would automatically end on March 31. The public purchase program, on the other hand, under present statutes, could continue until June 30. Which? Or What?

Industry-Wide Bargaining

SEVERAL weeks ago the U. S. Rubber Company entered into a company-wide agreement with the United Rubber Workers of America (CIO). In more recent weeks, a similar contract was negotiated between the Goodyear Tire & Rubber Co. and the rubber union. Because of these two contracts, and the wide publicity given to them, many people seem to believe that the rubber industry is engaged in industry-wide collective bargaining. There is no truth in any such belief. The contract between U. S. Rubber and the union, for example, is company-wide only to the extent that it applies to those plants where the union already held exclusive representation rights and under its terms supplementary agreements are to be locally negotiated on many matters specifically left to such determination. This is far from "industry-wide bargaining" and, according to Cyrus S. Ching, director of industrial relations of U. S. Rubber, simply "betters the prospect for continuing industrial peace without sacrificing fundamental rights of management, employee, or public." For a discussion of the pros and cons of industry-wide bargaining itself, we refer our readers to the speech made by Mr. Ching at the Conference of the American Management Association held in Chicago on February 26.

CURRENT NEWS OF THE MONTH

PUBLIC HEARINGS ON RUBBER LEGISLATION HIGHLITE DIFFERENCES OF TRADE OPINION

DIFFERENCES within the rubber industry with regard to either continued public purchase of natural rubber or an immediate return to free trading were brought politely but sharply into the open late last month, the occasion being public hearings held on February 26 and 27 by a subcommittee of the House Armed Services Committee at Washington, D. C. The hearings were held on two pending bills before the House—the Arends Bill (H. J. Res. 77), which proposes the extension of both purchase and allocation controls, and the Crawford Bill (H. J. Res. 118), which calls for the extension of allocation controls only. Unless some legislation is enacted before March 31, public purchase of natural rubber will probably end. Such public purchase could be continued until June 30 under the statute which empowers the Reconstruction Finance Corporation, but government authorities see no point in continuing such purchase if allocation control expires. Authority over allocation control is contained in the Second War Powers Act, which expires on March 31. The public purchase program would also end on March 31 if the Crawford Bill is enacted and subsequently approved by the Senate. A joint resolution, marking the first rubber legislation submitted to the upper chamber, was introduced in the Senate on February 28. Senators Bricker (Ohio), Cain (Washington), and Robertson (Virginia), all members of the Senate Banking and Currency Committee, proposed that all governmental controls over rubber be continued until the end of the fiscal year, namely, June 30.

Details concerning the Arends Bill were published in our last issue. The main provisions of the Crawford Bill, introduced as a joint resolution on February 10, include: (1) The maintenance of an adequate synthetic rubber industry in the United States in the interests of national security; (2) A complete study of the synthetic rubber situation with the view of accomplishing this purpose, and (3) The temporary continuation of the controls authorized in the Second War Powers Act which may be necessary in the interests of national security, except import control of natural rubber.

Majority Sentiment Expressed

Numerous witnesses, presenting both sides of the argument on the purchase of natural rubber, testified during the two-day public hearing at Washington. Contending that despite an apparent return to a free market both British and Dutch rubber producers are still under strict government control, W. S. Richardson, president of the B. F. Goodrich Chemical Co., urged that existing rubber controls be continued "as a package" rather than partially, pointing out that since the present combination (public purchase and allocation) had worked so smoothly in wartime it should not be disrupted now.

Indicating that he was voicing the opinion of the majority of the rubber manufacturing industry, Mr. Richardson warned that sudden partial ending of controls, meaning elimination of the purchase power, might produce a "deplorable situation." In such case, he pointed out, smaller manufacturers might be squeezed in the scramble for natural rubber and, also, the future of the synthetic rubber industry might be seriously impaired.

Other witnesses urging extension of government purchase of rubber included Robert S. Wilson, vice-president of the Goodyear Tire & Rubber Co., George Tisdale, vice-president of the U. S. Rubber Co., and Harry P. Schrank, vice-president of the Seiberling Rubber Co. In addition to urging that Congress permit exclusive public purchase until at least September 30 of this year, Mr. Wilson also urged that specifications be widened to permit the use of at least 60% of natural rubber in finished products instead of the present 42% now consumed in tires and other products.

Summation of Majority Sentiment

Basically, the arguments presented by those in favor of continued public purchase of rubber were along the following lines:

1. With a potential demand greater than available supply, economic forces will come into play which will delay and hold back rubber for this country. Unstable price conditions during a period of short supply encourage traders and producers to hold back shipments for higher prices thereby upsetting the flow of rubber or making it an intermittent process.

2. This will prevent a steady flow which can be had if the present situation is not disturbed. We then will have to hold up on continued improvements in quality of product by gradual revisions in specifications under R-1 because of the break in the flow of rubber.

3. The world market is not a free one but a controlled one. The Netherlands Government is the only seller from their Colonial areas in a position to sell. The British area is under a rigid exchange control set of regulations. These regulations are supported by British producers which in effect sets up a sellers' cartel. The majority opinion believes the public purchase program is the only one capable of assuring the United States receiving its share of available supplies. Government buying is the medium to deal with Government selling.

4. With the shortage of natural the industry must use synthetic to make up the deficit. The Congress must finally determine what is to be kept of the synthetic industry in the national interest. To operate it while Congress deliberates means there must be some orderly program of manufacture to keep any semblance of sound costs of production. The Rubber Reserve must in advance contract for their supplies of Butylenes, Butane and other raw materials for Butadiene and must have some program as to time and quantity. The majority of the Industry Advisory Committee are wholeheartedly behind the Administration and want this done.

5. Permitting so-called free buying will cause individual companies to endeavor to buy natural rubber, then apply by appeal to have specifications opened to permit its use. Competitors must then immediately endeavor to get more natural so they may do likewise. Since we know there is only so much available—no net good to the United States consumers can come from such unnecessary activities. The same thing is now being done under a most excellent and equitable plan followed by the Rubber Division of O.T.C. Small companies are being more than fairly handled and better so than they would fare under so-called free buying. The same supply is all there is available.

6. Pressure is now being exerted by foreign countries to permit manufactured materials made of all natural rubber to be imported into the United States while we must remain at about 42% of natural usage. Only an orderly flow of natural

to us will permit the goal of ⅔ natural—⅓ synthetic to be approached while we await Congressional action on the synthetic industry. Currently we are at a disadvantage in export against articles made of all natural rubber.

7. The maintenance of the flow which is needed for natural rubber plus synthetic is maintaining our great industry at full production to the advantage of our citizens and our greatest customer—the automotive industry.

8. The Industry Advisory Committee believes its request for temporary continuance of public purchasing of natural rubber is the surest way to keep up orderly reconversion, assure a steady and increasing flow of natural rubber and the operation of the synthetic facilities pending Congressional action. The rubber industry is not asking for and does not want a subsidy on its natural rubber requirements.

Urge Immediate Open Market

The majority of the witnesses appearing before the House Subcommittee, representing the so-called minority voice of the industry, favored return to an open market on rubber on April 1. These witnesses, like those urging continued public purchase, concurred in backing extended allocation powers to assure continued use of the war-built synthetic rubber industry for national security reasons. All witnesses emphatically endorsed the building up of a strategic natural rubber stockpile.

Heading the witnesses for an immediate return to free trading was Harvey Firestone, president of the Firestone Tire & Rubber Co. Mr. Firestone argued that since the British and Dutch had lifted wartime restrictions on rubber traders there was no basic reason for the United States government to continue its buying monopoly, and claimed that manufacturers could do as well as the government in purchasing rubber in the world market. Under questioning, he stated that he thought the other members of the "Big Four" were opposed to free trading at present because they believed it would lead to a price increase.

Pointing out that there was no "reasonable justification" for the continuation of exclusive government purchase of rubber, the Firestone executive added that "such a continuation might be construed as a buyer's cartel and place the United States in a very inconsistent position to oppose any future scheme to artificially control price through the restriction of the production of natural rubber on the part of the producers."

Administration officials also urged end of government purchasing of rubber. Secretary of War Patterson sent a message to the hearings in which he stated that "exclusive public purchase is no longer necessary for national security." The message added that in the opinion of the War Department the continued allocation provisions are ample from the security viewpoint.

A representative of the Navy Department, appearing at the hearing, went a step further and said that dependence of rubber manufacturers on government buying may be inimical to the national interest, because the government is not accumulating any rubber for its own strategic stockpile. He also stated that there is no natural rubber in the stockpile at present, while Rubber Reserve stocks on hand amount to only some 200,000 tons. He urged that private traders take over the importing job and that Rubber Reserve limit its buying to stockpile requirements.

The State Department submitted a letter to the hearings indicating that an extension of public purchase is unnecessary. It said continuation of such buying "may raise difficult problems with other countries inasmuch as private traders of other nations are permitted to buy natural rubber." The State Department gave its endorsement to the Crawford Bill.

The Department said there is no truth to charges that the British and Dutch Governments are secretly maintaining cartel arrangements designed to set up "sellers market" or that either Government is doing this individually. The British Government has given the United States assurances to this effect within the last few days, the Department said. Britain, it was pointed out, does maintain some control through its exchange regulations but these are not intended to influence price or restrict the sale of rubber.

Some Additional Testimony

Other witnesses appearing in favor of resumption of free trading included Alan Grant, vice-president of the Charles T. Wilson Co. and former president of the Rubber Development Corp., and Thomas Robins, Jr., president of Hewitt-Robins, Inc. The latter said his company "sees absolutely no justification for continued government buying" and added that "foreign rubber users have outbid our government for rubber known to be available."

Mr. Robins also suggested that the Crawford Bill be amended to limit its allocation authority. As the bill now stands, according to Mr. Robins, it could be construed as providing for allocation of imported stocks between manufacturers, and he urged that it be more clearly defined to limit "allocation controls" to mere specification controls over individual rubber products, as now exercised by Rubber Order R-1. He also asked that some import controls be imposed to prevent an influx of foreign-made products that contain lesser percentages of synthetic and higher percentages of natural rubber.

Representative Crawford, appearing in defense of his own bill, told the subcommittee that the RFC has "failed at buying rubber" because private traders of other nations are outbidding the United States, with the result that high quality natural rubber is going to other nations while lower grades are being sold to the United States. Moreover, he warned that the public purchase program can be "very harmful" because the RFC, after acquiring substantial quantities of rubber, might be faced with a decline in world rubber prices, a loss which the government would have to absorb.

In addition to the numerous witnesses appearing during the two-day hearing in Washington, several other interesting reactions should be noted. On February 26, the first day of the hearing, Representative Sam Rayburn, Democrat minority leader in the House, announced that recommendations of President Truman for the future of the nation's synthetic rubber plans will be outlined to Congress soon in a special message. The problem, he added, is now under consideration at the White House. On February 13 President Truman, when questioned about details he has in mind on this subject, stated that maintenance of standby synthetic rubber plants "is essential to the nation's future security."

In a statement issued on February 17, the Rubber Trade Association of New York, Inc., announced that it wholeheartedly supports the Crawford resolution. It again emphasized its position to the effect that the government should take all steps necessary to insure the continuation of the synthetic rubber industry, and the production and use of an amount of synthetic rubber annually which will satisfy the requirements of national security, together with the maintenance of an adequate stockpile of natural rubber as provided for by the Strategic and Critical Stock Piling Act. The statement indicated that in the Association's belief the restrictions on the purchase and import of natural rubber are no longer necessary.

In a statement made in New York on February 25, John L. Collyer, president of the B. F. Goodrich Co., emphasized his company's stand for the continuation of present government controls on natural and synthetic rubber and said that a sound long range synthetic rubber program should be established by adequate legislation before any basic change is made in existing rubber programs.

Production of Natural Rubber

According to the Office of International Trade of the U. S. Department of Commerce, production of rubber in the Malayan Union during December, 1946, amounted to 53,349 long tons, as compared with 52,562 in November and 47,193 in October. Stocks on hand at the year-end were reported at 148,711 long tons. Total exports of rubber and latex from Malaya in December amounted to 69,163 tons, of which 43,061 tons were shipped to the United States. The same source indicated that exports from Indochina during 1946, including December shipments of 14,482 tons, amounted to 135,449 tons. Total new production during 1946, however, was said to have been less than 20,000 tons. Liberia was reported to have shipped a record 20,655 long tons of rubber to the United States during 1946, of which 6,790 tons were rubber latex.

PRODUCTION OF TIRES IN 1946 ESTABLISHES ALL-TIME RECORD

The American tire industry established an all-time record of 66,734,441 passenger car and motorcycle tires in 1946, according to a report released recently by the Civilian Production Administration. This was an increase of 136% over the 28,292,112 units produced in 1945, and surpassed by more than 15,000,000 the pre-war record of 51,000,000 passenger car and motorcycle tires achieved in 1940. A total of 19,030,059 passenger car and motorcycle tires were manufactured in the fourth quarter of 1946. Previous peak production was 16,651,169 units in the third quarter of the same year.

The 15,837,039 truck and bus tires produced in 1946 were 3% less than the record of 16,354,445 units built in 1945 which saw the peak of miiltary demand. This increase was due to the fact that the wartime backlog and current demand for large truck and bus tires had been fairly well met by the middle of 1946, W. James Sears, director of the CPA Rubber Division pointed out. Thereafter, rubber manufacturers concentrated on passenger car and small truck tires.

Along with the high rate of passenger car and motorcycle tire production, the industry was able to build 4,811,814 tractor and implement tires in 1946, an increase of 79% over 1945 production. Bicycle tire production was 9,061,296 units in 1946, an increase of 79% over 1945. Demand for airplane tires dropped sharply in 1946 and only 258,739 units were produced, a decrease of 68% from 1945 production. Likewise, the demand for camelback dropped in 1946 so that production of 76,246 long tons was sufficient to meet requirements. This was a 44% decrease from the 1945 production level.

According to Mr. Sears, the rubber manufacturing industry, during the fourth quarter of 1946, apparently ran at full capacity for peacetime operation of peacetime facilities. The backlog and current demand for passenger car tires has been fairly well satisfied. Although it may not be possible for the motorist to buy the brand of tire he wants the moment he wants it, he can always find a tire to fit his car when he needs it.

The industry has scheduled an all-out production rate for the first quarter of 1947. If the record production level of the fourth quarter of 1946 can be maintained, the distributing pipelines of the tire industry will be reasonably well filled to supply the motorist with the tires he will need for his 1947 driving.

As more new automobiles and other rubber-tired vehicles are produced, Mr. Sears declared, more tires will be required for original equipment, so that it is doubtful that the record number of civilian replacement passenger car and motorcycle tires provided in 1946, a total of 54,791,657 units, will be available for replacement in 1947.

Tables of production and civilian replacement shipments of tires during 1945 and 1946 follow herewith:

PRODUCTION OF TIRES AND CAMELBACK
(Comparison of 1946 with 1945)

	1946	1945	% Diff.
Airplane Tires.	258,739	820,556	— 68%
Truck and Bus Tires	15,837,039	16,354,445	— 3%
Tractor and Implement Tires	4,811,814	2,695,317	+ 79%
Passenger Car and Motorcycle Tires	66,734,441	28,292,112	+136%
Bicycle Tires..	9,061,296	5,054,477	+ 79%
Camelback (long tons)	76,246.7	135,678	— 44%

CIVILIAN REPLACEMENT SHIPMENTS
(Comparison of 1946 with 1945)

	1946	1945	% Diff.
Truck and Bus Tires	10,810,298	6,430,554	+ 68%
Tractor and Implement Tires	2,399,059	1,105,975	+117%
Passenger Car and Motorcycle Tires ...	54,791,657	25,470,974	+116%

Coming Events

Mar. 17-19. N.A.W.M.D. Hotel Sherman, Chicago, Ill.

Mar. 20. Northern California Rubber Group, Angelo's Restaurant, Emeryville, Calif.

Mar. 21. Chicago Rubber Group, Hotel Morrison, Chicago, Ill.

Apr. 1. Los Angeles Rubber Group, Mayfair Hotel, Los Angeles, Calif.

Apr. 9-11. S.A.E. National Aeronautical Meeting, Hotel New Yorker, New York City.

Apr. 11. New York Rubber Group, Hotel McAlpin, New York City.

Apr. 14-18. A.C.S., 111th Meeting, Atlantic City, N. J.

Apr. 22. Buffalo Rubber Group. Joint Meeting with Ontario Rubber Group. Hotel Brock, Niagara Falls, Ont.

May 9. Akron Rubber Group, Hotel Mayflower, Akron, Ohio.

May 9. Chicago Rubber Group, Hotel Morrison, Chicago, Ill.

May 9. Connecticut Rubber Group.

May 16. Detroit Rubber & Plastics Group, Detroit-Leland Hotel, Detroit, Mich.

May 26-28. Rubber Division, A.C.S., Spring Meeting, Hotel Cleveland, Cleveland, Ohio.

June 16-19. A.S.M.E. Semi-Annual Meeting, Stevens Hotel, Chicago, Ill.

June 16-20. A.S.T.M., Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

June 27. New York Rubber Group, Annual Outing, Blasberg's Grove, Hawthorne, N. J.

Sept. 15-19. A.C.S., 112th Meeting, New York City.

G-E Purchases Lowell Plant

General Electric Co. has purchased the government-owned wire factory at Lowell, Mass., from the War Assets Administration. The factory, to be operated by the company's appliance and merchandise department, will produce building wire and other electrical construction materials.

SLOAN PREDICTS FIVE YEARS OF RECORD TIRE PRODUCTION

Tire manufacturers in the United States will produce an average of 78,000,000 to 80,000,000 units annually during the next five years, with a low of probably not under 73,000,000 units, according to a prediction made by J. H. Sloan, business analyst of the B. F. Goodrich Co., at a meeting of the Akron Optimist Club, held in Akron on February 19. He indicated that the biggest problem which plagued the rubber industry in the past, namely, wide fluctuations in the prices of raw materials, is on the way to being eliminated.

In discussing the prospects of business in general, Mr. Sloan felt that industrial production in 1947 would even surpass that of 1946, a record peacetime year. Admitting that the volume of industrial production at the end of 1947 will be well under the present rate, he did not expect it to decline enough to deserve the scare head "recession." Prices have been climbing steadily since last fall and will continue upward because another round of wage increases is anticipated, not as large as in 1946, but enough to force prices higher, he said.

The industrial index, a system used to measure production volume, is now at about 185. The Goodrich analyst felt that this year's average will be 178, as compared with 170 in 1946, with the peak rate of 186 to 190 being reached in April or May. Then the effect of gradual restoration of inventories to normal levels will be felt and production will decline.

Mr. Sloan predicted the following adjustments within the next twelve to eighteen months: revision of prices, both farm and industrial; shift in buying emphasis from soft lines to hard (autos, refrigerators, etc.); labor legislation to promote industrial peace; tax reductions; and settlement of international problems relating to peace.

Resume Publication of "Activator"

Publication of *The Activator*, technical house organ of the company, which was suspended during the war, has been resumed by the New Jersey Zinc Co., 160 Front St., New York 7, N. Y. The first of the resumed issues is dated December, 1946 (Vol. 8, No. 1), and contains the most recent information on zinc oxides for natural and synthetic rubber and zinc oxide-GR-S compounding. Divided into two sections, the first gives a complete, up-to-date description of the chemical and physical properties of the several brands of zinc oxide recommended by the company for natural and synthetic rubber compounding, while the second explains how the difficult compounding problem for larger than activating amounts of zinc oxide in GR-S has been partially solved. Other synthetic rubbers are also discussed. Copies of *The Activator* are available on request to the company.

TREMENDOUS DEMAND FOR LATEX PREDICTED IN SPECIAL REPORT

Demand for rubber latex in the United States for the current year of 1947 will be well over 50,000 tons, and eventual demand is expected to reach proportions of 10,000 tons monthly, according to a special article by Arthur Nolan, vice-president of Latex Distributors, Inc., of New York, in the January 15, 1947, issue of *Lockwood's Monthly Rubber Report.* A reprint of the report was recently distributed by Mr. Nolan's organization.

Based on observations made during a recent three-month tour of rubber-producing areas in the Far East, as well as visits to London and Amsterdam, the report indicated that whereas consumption of liquid latex in 1940 amounted to some 2,500 tons, largely of Hevea latex, current consumption is on the order of 4, 975 to 6,425 tons a month, made up of approximately 600 tons of Hevea, 2,000 to 2,500 tons of GR-S, 1,375 to 1,725 tons of neoprene, and the balance of reclaimed rubber latices.

In 1940 Malaya produced an average of 1,907 tons of latex monthly. Because of political disturbances in the Netherlands East Indies, it is obvious that Malaya will be the prime source of latex this year. Malayan capacity to produce rubber, approximately 50,000 tons a month in 1941, has not been materially reduced. The report points out that while only a fraction of this capacity can be turned over to latex, "it seems a reasonable assumption that 10% of the crop (5,000 tons a month) could be turned to latex." This amount, it is emphasized, could meet U.S.A. requirements until such time as Sumatra would come into latex production. Despite the labor situation in Malaya, latex producers can obtain sufficient estate labor.

On the equipment score, according to the report, numerous centrifuges remained in Malaya, in working order, while others can be quickly rehabilitated. Although Malayan stocks of steel for tanks and piping are small and rapidly dwindling, there are good prospects of steel supplies being supplied by the United States and Australia. In emergencies, it is stated, teakwood or concrete may be used in tank constructions. The threat of lack of cylinders for transporting ammonia is rapidly disappearing with the re-appearance of prewar cylinders. So few motors and valves are required that this is no problem, while engines for air compressors or generators and compressors are available from current supplies or military surpluses.

Discussing the chemical situation, the report states that sufficient ammonia will be provided from both U.S.A. and United Kingdom sources to meet Malayan requirements. Creaming agents are currently in supply but as demand increases facilities for their production will either have to be increased or local Malayan gums used.

The drum situation, however, according to the report, is acute, with practically all the available drums now in Malaya being used to ship latex to continental Europe. The present small supply of second-hand Diesel fuel drums is expected to be absorbed very shortly. A Singapore drum fabricating plant is expected to start production shortly which will prove of some help. The acuteness of the drum situation, however, is said to warrant erection of bulk handling facilites.

With regard to bulk handling, the report points out that one large Singapore unit for ship loading of bulk latex was put into operation shortly after the Allies moved into Malaya and this unit now provides the U.S.A. with the only Malayan latex now being shipped to this country. The only other American-operated installation in Malaya was badly damaged and is currently undergoing reconstruction and repair. Four new bulk handling units are scheduled.

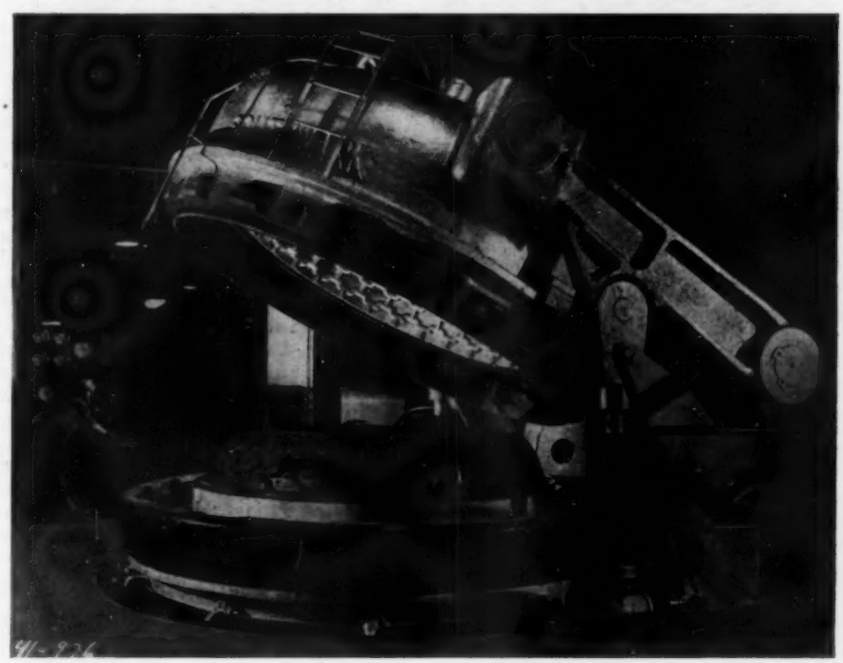
Other factors mentioned in the report included these: (1) Although many of the 70 to 80 ships equipped to carry bulk latex in the prewar period are no longer afloat, U.S. steamship companies give evidence of their readiness to transport 50,000 to 100,000 tons of latex to the United States annually; (2) Facilities in this country for unloading, transporting and storing liquid latex are now being operated appreciably under top capacity, but can easily and quickly be expanded when necessary.

According to the summation made by the report, rubber producers in the Far East are quite prepared to handle the world-wide demand for latex, especially that of the United States, but are awaiting clarification of both American and British policies before making commitments.

DS 207 Stabilizer and Lubricant

A new dibasic lead salt of stearic acid has been introduced by the National Lead Co., 111 Broadway, New York 6, N. Y., as a stabilizer and lubricant for vinyl compounds. Known as DS 207, the material is said to have some degree of solubility in tricresyl phosphate and several other plasticizers, and to be very soluble in mixtures of either tricresyl phosphate or dioctyl phthalate and some of the aromatic petroleum type plasticizers. According to the manufacturer, DS 207 produces clear amber films when the aromatic petroleum type plasticizer is used to the extent of 50% or more, or comprises the total plasticizer content. It is also reported to be an excellent replacement for the lubricants commonly employed with vinyl compounds to improve flow characteristics. The material has a molecular weight of 1220, a specific gravity of 2.02, a refractive index of 1.60, and is said to decompose above 300° C. without melting.

GIANT MOLD STILL TURNING OUT MASSIVE TIRES AT FIRESTONE PLANT



Big tires are big business for the Firestone Tire & Rubber Co. When the Army Air Forces needed its first big tire for the once-famous B-19 bomber, Firestone engineered an 8-foot smooth-contour tire and built a giant mold in which to cure it. This mold, although more than eight years old, still remains the largest in the world, according to the company, the top section weighing more than 32,000 pounds. Largest tire ever cured in this or any other mold is said to be the earth-mover tire used by Army engineers in airfield construction during the war years that measures 9½ feet high and 38.7 inches wide. This tire has a carrying capacity of 49,200 pounds at 25 m.p.h. and weighed 3,646 pounds.

Announce Synthetic Price Reductions

Effective with permits issued on or after February 1, the Office of Rubber Reserve (RFC) will sell GR-M or GR-M 10 "Off Grade A" material, so designated because of the over age of the material, at 15c a pound, f.o.b. plant, Louisville, Kentucky, plus the applicable uniform freight charge. This material formerly sold at 20c a pound. Due to the over age of the material, Rubber Reserve does not guarantee the uniformity of it and all sales will be made with no representation or warranty as to quality.

As of February 1, Rubber Reserve had on hand 309,670 pounds of GR-I-X, the modified polyisobutylene produced for wartime requirements, which is of value for the manufacture of cements, wire and cable insulation, pressure sensitive tapes, etc., and as a plasticizer for synthetic rubber compounds, waxes, resins, etc. The remaining quantities of this material, available in 9 different grades, is offered for sale at the reduced price of 25c a pound plus freight charges.

On February 7 Rubber Reserve announced that ceiling prices on GR-S latex in drums or other containers covered in Exhibit F of its General Sales and Distribution Circular, issued July 1, 1945, were withdrawn. The purpose of this move is to enable the authorized "GR-S Latex Distributors" to reflect the amount of the recent increase in the uniform freight charge in their resale prices for drummed GR-S latex. It is believed that the existing ample supply situation on GR-S latex will control and prevent any price increases in drum sales of such latex except as necessary to compensate for the aforementioned increase in the uniform freight charge.

Tire Holds High Air Pressure

A special type of tire manufactured by the B. F. Goodrich Co., for the D-55 "Skystreak," which was introduced by the United States Navy recently, is said to carry higher air pressure than any previous airplane tire ever constructed. Having a cross section of 4.4 inches and an over-all diameter of 20 inches, the tire is said to carry 175 pounds of air pressure per square inch. The extraordinary pressure is needed because of the great weight (9750 pounds at take-off) that must be carried because of the limited space for retracting wheels in flight. The tire has an eight-ply all-nylon carcass.

Enters Toy Balloon Field

The Northwest Popcorn and Seed Co., 37 East Winter St., Delaware, Ohio, has installed a complete manufacturing plant for the production of toy balloons which it is offering under the name of "Big Pop Toy Balloons." The company has established a Balloon Manufacturing Division and is already turning out quantities of various size balloons. A. G. Dumbauld is sales manager of the new division.

Sets Up Consulting Service

Henry F. Palmer

Dr. Henry F. Palmer, who resigned last fall from the Firestone Tire & Rubber Co. after more than 21 years of service with that organization, is now engaged in private practice as a consultant serving the rubber and chemical industries with headquarters at 715 West Market St., Akron 3, Ohio. Dr. Palmer is a recognized expert in all phases of production and use of all types of rubber, including reclaim and synthetic, and has had wide experience in technical sales, direction of research and development programs, and general rubber technology.

Born July 2, 1899, in Lynn, Mass., Dr. Palmer received an A.B. from Dartmouth College in 1921, an M.S. in 1922 from Ohio State University, and a Ph.D. in 1925 and a Ch. E. in 1938 from the same university. He served as an instructor in chemistry at Dartmouth from 1922 to 1923 and joined Firestone in 1925 as a research chemist, remaining with that company until his resignation last year. From 1926 to 1942 he served as chief chemist of the Xylos Rubber Co., Firestone subsidiary, and became assistant chief chemist of the parent company in 1942. From 1942 to 1944 he was on loan to the Rubber Reserve Co. in Washington where he served as production manager of the synthetic rubber plants and was responsible for much of the ground work in getting the synthetic program organized and under way. Returning to Firestone in late 1944 he served as assistant director of chemical laboratories until his resignation.

Dr. Palmer is the author of over 25 publications and patents on a variety of rubber subjects. His organization memberships are numerous, including the American Chemical Society, American Institute of Chemists, American Institute of Chemical Engineers, and the Ohio Society of Professional Engineers. He is a Mason and a Shriner, and a member of Alpha Chi Sigma, Gamma Alpha, Phi Lambda Upsilon, Sigma Xi, and the Torch Club.

Renew Wage Negotiations

Wage negotiations between representatives of the United Rubber Workers (CIO) and Goodyear, Goodrich, U. S. Rubber and Firestone, on the union's demand for a 26-cent hourly wage increase, which were suspended on February 4, were renewed at Cleveland on March 5. All local unions of the "Big Four" recently voted for conditional strike action in support of the wage demands, the strike vote indicating that 90.1% of the voting members having favored such action. Other labor news of importance during the past month included the following: Goodyear signed a company-wide contract with the U.R.W.A. on February 11; Judge Phillip Forman refused on February 15 in the U. S. District Court at Trenton, N. J., to dismiss an action brought by the Thermoid Co. against certain officers and members of the U.R.W.A. in which the company seeks to recover $175,000 as damages accrued as the result of a recent strike; virtual concession of defeat on the portal-to-portal pay issue was made by the general executive board of the rubber union at Cleveland on February 28; testifying before the Senate Labor and Welfare Committee at Washington on February 14, T. G. Graham, Goodrich vice-president, asserted that limits on the daily production and earnings of employees were commonly established and enforced by collective bargaining representatives, citing figures applying to one of his company's manufacturing divisions.

California Hears Winlund

Approximately 60 members and guests heard E. S. Winlund, industrial electronic engineer of the Radio Corporation of America, deliver a talk on "Electronic Heat Sealing" at the February Meeting of the Northern California Rubber Group, held at Angelo's Restaurant in Emeryville, Calif., on February 27. In his talk, Mr. Winlund outlined the advantages and limitations of electronic heat sealing and explained in detail application methods, production rates, and installation. The use of both electronic sewing machines and die sealing equipment, particularly those produced by the Singer Sewing Machine Co., the Union Special Machine Co., and RCA, in sealing thin sheets of plastic and rubber materials in the formation of raincoats, beach balls, shower caps, etc., was described.

Witco to Build Stearate Unit

To fulfill growing requirements for metallic stearates, the Witco Chemical Co. is constructing a stearates manufacturing unit at its present plant in Chicago, Ill., to serve the Midwest area. Expected to begin operations May 1, the new unit will mark further expansion of the company in the stearates field and supplement the production of its present Torch Club. He served as chairman of the Akron Section, A.C.S., in 1928, and as a member of the Executive Committee plant in Brooklyn, N. Y.

RUBBER RECLAIMERS GROUP GIVES 1946 PRODUCTION DATA

The Rubber Reclaimers Association, which maintains headquarters at 250 West 57th St., New York 19, N. Y., announced on March 5 that production of reclaim rubber in 1946 totalled 295,655 long tons, a significant gain of more than 20% from the 1945 output of 243,309 tons. Reclaim production was particularly high in the last quarter of 1946, averaging 25,456 tons monthly, the highest monthly average for any three-months' period since 1943.

In announcing these significant gains, the Association points out that, before the creation of the war-born synthetic rubber industry, reclaim rubber represented this country's first line of rubber defense, and that even in normal times it forms a vital part of the total rubber supply picture. The present production level of approximately 300,000 tons of reclaim per annum compares with the Batt Committee proposal that the United States maintain a minimum production of synthetic rubber totalling 200,000 to 250,000 tons per annum.

Reclaim rubber, it is pointed out, has superior qualities which in many products make its use preferred by manufacturers for quality as well as price reasons.

The industry does not require government protection, according to the Association, which emphasizes, however, the importance of taking no national action with regard to either natural or synthetic rubber which would prejudice the continued well-being of the reclaim industry.

"A sound national rubber policy," states the Association, "is based on a three-legged program which recognizes the importance of reclaim rubber, along with natural and synthetic, as a vital factor in national security and expanding peacetime rubber consumption."

I. R. I. Plans Latex Conference

The Manchester and District Section of the Institution of the Rubber Industry has scheduled a conference on "Production and Uses of Natural and Synthetic Rubber Latices" at the Grand Hotel in Manchester, England, on May 6. Approximately twelve short papers will be presented by leading authorities on every aspect of the subject, including production of latex, spontaneous coagulation and preservation, concentration, transport, storage, specifications, compounding, ingredients, and the various applications of latex in industry. Emphasis will be placed on future trends rather than on the historical aspect of the subject.

Firestone to Call Stock

Firestone Tire & Rubber Co., Akron, has announced that on March 17 it will call for redemption of 250,000 shares of the 414,000 outstanding shares of 4½% preferred stock, at $106.32½.

Antioxidant Reduction

The Office of Rubber Reserve (RFC) has announced that in the production of regular, special purpose and experimental GR-S polymers, effective on or before March 1, a reduction of antioxidant from approximately 1.5% to approximately 1.25% will be made. This reduction does not apply to carbon black or other pigmented masterbatches, or to non-staining polymers stabilized with EFED.

Antioxidants are incorporated in GR-S polymers to stabilize the raw polymer before compounding rather than to protect the end product from oxidation. This reduction is due primarily to the seriously limited availability of certain antioxidants.

Unless otherwise stated in the production authorizations, which are published regularly in this journal, the antioxidant content of all GR-S polymers, including experimental types established after March 1, will conform to this policy.

End Inter-Agency Rubber Group

Termination of the Inter-Agency Policy Committee on Rubber was announced on February 12 by John R. Steelman, assistant to President Truman, with the resignation of William L. Batt, its chairman. The committee's work was said to have been concluded when the President submitted recommendations to Congress on February 7 regarding the future legislative program for rubber. Mr. Steelman revealed that members of his own staff will handle further inter-agency coordination as may be required. In thanking Mr. Batt for his services, Mr. Steelman declared that the government might again need his broad knowledge and understanding of industrial and international affairs. Mr. Batt became head of the committee when it was created in September, 1945. Previously, he had served with the War Production Board.

Permit Butyl for All Tubes

Butyl rubber may now be used in the manufacture of tire tubes of all sizes and types. Previously, the supply of butyl was not sufficient for unrestricted use in tubes and it was prohibited in tubes of 7:00 inch cross section and larger. This restriction was removed by Direction to Appendix II of Rubber Order R-1, effective February 7. Manufacturers now have the choice of using butyl or natural rubber in tubes for truck and bus tires. The use of natural rubber in passenger car tubes and certain types of small tubes is still prohibited.

DOMESTIC RUBBER CONSUMPTION INCREASED BY 29.43% IN 1946

During 1946 the consumption of natural and synthetic rubber in the United States amounted to 1,034,190 long tons, an increase of 29.43% over the 799,009 long tons consumed during the previous year, according to a report issued by the Rubber Manufacturers Association. For the month of December, rubber manufacturers consumed 92,533 long tons of both natural and synthetic rubber, as compared with 95,117 long tons used in November, a decrease of 2.72%.

Natural rubber consumption increased 163.27% in 1946, totaling 277,562 long tons, as compared with 105,429 tons in 1945. Consumption of natural rubber for the month of December amounted to 38,767 long tons, against 37,323 tons consumed during the previous month, an increase of 3.87%.

Consumption of synthetic rubber in 1946 totaled 756,628 long tons, an increase of 9.09% over the 693,580 tons consumed during the previous year. December consumption of synthetic rubber amounted to 53,766 long tons as compared with 57,794 tons consumed during November, a decrease of 6.97%. During 1946, synthetic rubber was consumed in the following proportions: 626,960 tons of GR-S; 44,420 tons of neoprene; 79,224 tons of Butyl; and 6,024 tons of nitrile rubber.

Reclaimed rubber consumption in 1946 increased 14.30% over the previous year, rising from 241,036 tons to 275,497 tons, while consumption for the month of December amounted to 23,684 tons, as compared with 24,385 tons consumed during the month of November, a decrease of 2.88%.

French Rubber Industry

In 1947 the French rubber industry expects to buy 25,000 tons of the 50,000 tons of the French Government-held rubber stocks, according to a report in the British press, quoting a spokesman for the French National Rubber Association. The French representative also stated that the remainder of the needs of the French industry, approximately 37,000 tons, were to come from Indo-China and Singapore, and that the Association had permission to buy 50,000 tons of cotton on the Egyptian market for the use of the rubber industry. Production of tires and industrial rubber products in France reached a level in September, 1946, which was almost equal to that of prewar months, amounting to 3,670 tons of tires and 1,500 tons of industrial rubber products.

Moves Office in Boston

The Boston office of Binney & Smith Co. has been moved to new headquarters at 1121 Park Square Building, Boston 16, Massachusetts. The telephone number of the office remains the same at LIBerty 7011. Alan W. Bryant is in charge of the office.

Goodyear Shifts Executives

Russell DeYoung

Three important changes in the top management of the Goodyear Tire & Rubber Co., Akron, have been announced by the company. Russell DeYoung, who has been vice-president and general manager of the Goodyear Aircraft Corp., has been appointed vice-president in charge of production for the parent company, succeeding Cliff Slusser, who has been named vice-president and general manager of the subsidiaries which operate the company's textile plants and coal mines, while Fred W. Climer, formerly assistant to the president, has been elected vice-president in charge of industrial relations. Mr. DeYoung was graduated from the University of Akron in 1932, specializing in industrial engineering. During his university course, he worked part time in the Goodyear plants. In 1933, he became a supervisor in the company's tire plant, and in 1934 joined the Goodyear group which was assigned to the organization of the company's new tire factory in Java. Returning to Akron in 1935, he worked in the development division until 1939 when he was awarded one of the Sloan scholarships at M.I.T. and took a leave of absence to gain his master's degree in business and engineering administration. Mr. DeYoung became assistant to the president of Goodyear Aircraft in 1940 and later vice-president of that organization in charge of manufacturing. He was named general manager of Goodyear Aircraft in 1946.

Rubber-coated canvas work gloves which are expected to have many industrial and household uses are being produced by U. S. Rubber. Made by dipping the canvas in latex up to the wrist and then vulcanizing, the gloves are said to offer better protection to the hands and to outlast many pairs of conventional canvas gloves.

December Issues Wanted

Although a large demand was anticipated for extra copies of our December, 1946, issue, which contained the Panel Discussion on Processing of Natural and Synthetic Rubber, presented before the New York Rubber Group last October, the demand far exceeded the supply. We would like to secure additional copies of that issue to fill requests and will pay 50c for each copy returned to us. Please send the copies to: Circulation Manager, RUBBER AGE, 250 West 57th St., New York 19, N. Y.

Index Guide to OTS Reports

The first volume of a comprehensive index guide to tens of thousands of reports on technological developments in the United States, Germany, and other countries has been made available by the Department of Commerce. The index is intended for use with the *Bibliography of Scientific and Industrial Reports*, which has been issued weekly by the Office of Technical Services since January, 1946, and which lists and gives a brief abstract of all reports acquired by OTS. Containing about 45,000 cross reference entries classified under major subject headings, the new index guide lists the file number of each report and refers to the page number of the Bibliography. The first volume of the index covers the first 25 issues of the Bibliography from January 11, 1946, through June 28, 1946. Future volumes will cover quarterly periods. The index, designated as the "Index to the Bibliography of Scientific and Industrial Reports," may be purchased from the Superintendent of Documents, Washington, D. C., at 50c a copy.

Rubber Publicity Unit Created

A publicity bureau to acquaint the American public with new rubber products and developments in the field of rubber has been established by leading world producers of natural rubber at 1631 K Street, N. W., Washington, D. C. To be known as the Rubber Development Bureau, the new organization will not only try to keep the public informed through publicity channels of new developments in the rubber field, but will also cooperate with American rubber manufacturers in introducing new products to the public. The Bureau is a revival of a similar organization which was established in Washington shortly before the start of the war by the same group of rubber producers. Warren S. Lockwood, foreign trade and rubber consultant and formerly executive vice-president of the Rubber Manufacturers Association, will serve as director of the Bureau.

Named Technical Director

A. C. Peterjohn

Alvin C. Peterjohn, formerly associated with the Fort Clinton, Ohio, Division of the Standard Products Co., has been appointed technical director of the C. P. Hall Co., Akron. After graduating from the Case School of Applied Science in 1915, Mr. Peterjohn joined the Mechanical Rubber Co., Cleveland, Ohio, a subsidiary of the U. S. Rubber Co. When this plant was closed in 1929, he was transferred to the mechanical goods division of U. S. Rubber at Passaic, N. J. He remained in Passaic until joining Standard Products several years ago.

Form West Coast Chemical Firm

American Mineral Spirits Co. and the Richfield Oil Corp. have formed the American Mineral Spirits Co. Western at 555 Flower St., Los Angeles, Calif., for marketing petroleum solvents and technical naphthas. All products to be marketed by the new company will be made by the Richfield Oil Corp. at its plant in Watson, Calif. Crude oil and catalytic cracking base stock will be processed into petroleum naphthas of both the aliphatic and aromatic types. Max A. Williams, vice-president of American Mineral Spirits Co., has been named president of the new organization, while David E. Day, vice-president in charge of manufacturing for the Richfield Oil Corp., has been appointed executive vice-president.

A new rubber link matting, of entirely new design, has been introduced by Goodrich. Called "Multi-Length," the matting is made in 30-inch width and without nosing and will be sold in rolls containing 30 lineal feet.

A new booklet describing its aluminum building wire has been made available by the Hazard Insulated Wire Works Division of the Okonite Co., Wilkes-Barre, Penna.

MINUTES OF RUBBER CONSULTING TECHNICAL COMMITTEE MEETINGS

In accordance with the policy established last month of publishing the minutes, either in full or part, of meetings of various consulting technical committees with government officials, we publish herewith the minutes of two recent meetings.

Two things must be remembered in connection with these minutes: (1) They cover that portion of the meeting attended by representatives of the Office of Rubber Reserve; (2) By nature of their purpose, the meetings do not reflect the favorable side of synthetic rubbers. The minutes follow herewith:

Meeting of the Rubber Mountings, Shock-Absorbers and Dampers Consulting Technical Committee. Held: January 14, 1947. Government Presiding Officers: Aden R. Miller (OTC-CPA), L. A. Woerner (ORR). Chairman: J. D. Morron (U.S. Rubber).

Under the present R-1 Order, natural rubber is allowed on the following products on which this Committee is consulted: (1) Expansion joints, flexible couplings. (2) Aircraft engine and instrument mounts. (3) Automotive engine, transmission, and propeller center bearing mountings, bumpers for independent suspension mechanisms, radius rod, pivot balls, shock and instrument mounts, torsional vibration dampers, vibration insulators and absorbers, and pitman arm bushings, shock absorber bushings, suspension shackle bushings, tail pipe bushings, torque arm bushings, and street car wheel sandwich rings and springs.

This pattern was maintained throughout the war on the recommendations of the Army and the Navy. Thus, most mounts now being produced are based on pre-war designs in which natural rubber was the flexible component. It was reported that it would be necessary in many cases to redesign mounts as now used with natural rubber, if synthetic rubber were substituted for it.

However, considerable progress is being made in some quarters in adapting GR-S to automotive motor mounts. The applications of GR-S have been based on desirable dampening characteristics plus superior heat resistance. These features of GR-S have already been incorporated in both shear and compression motor mounts on current models and are approved for other cars in the 1948 line.

Of the total usage of synthetic rubber by this group, one-third might be approached if GR-M were included. The GR-S consumed under present conditions for these purposes was considered to be insignificant. GR-M mounts were specified in several cases by some purchasers because of good oil resistance and by others for superior heat resistance. GR-S could be best used in bumpers.

It was pointed out that an important consideration in the rubber component of mounts was to have the smallest possible variation in physical properties over the full temperature range. The usefulness of a mount is impaired if this variation with temperature is not limited.

The general direction of physical properties based on present designs for an improved GR-S were indicated to be:

1. Higher resilience and lower heat generation.
2. Improved tear resistance, particularly while hot.
3. Increased flex life.
4. Low creep or drift.
5. Good bonding characteristics.
6. Minimum change of properties with temperature variations.

In several cases it was felt that 100% GR-S compounds were preferable to blends of GR-S and natural rubber. Blends of GR-S and natural rubber were considered to form a two-phase system in the final product by one company. This tendency, if true, might be greatly reduced or eliminated by investigating blends of the isoprene polymers, X-141 and X-281, with natural rubber.

Isoprene polymers tend to undergo the same type of chemical reactions as natural rubber and have thus the same tendency towards reversion and heat softening after vulcanization which should eliminate the possibility of a two-phase system. X-141 has been reported to have lower hysteresis and thus lower heat generation, improved tack, higher resilience, faster cure rate, and better tear resistance than standard GR-S.

Based on their development work, one committee member indicated that the isoprene polymers were of greatest interest for mounting applications. Rubber Reserve now has under development in the pilot plant stage three additional isoprene polymers, XP-64, XP-65, and XP-66, which may be described briefly as:

XP-64: 75 Isoprene, 24.5 Styrene, 0.5 Divinylbenzene, rosin soap emulsification, alum coagulation, 65±8 Mooney, PBNA stabilizer (X-141 type with cross linking agent to obtain better processing, except that isoprene replaces butadiene, analogous to GR-S-60 formerly X-285).

XP-65: Control for XP-64. Same description except Divinylbenzene is omitted.

XP-66: 90 Isoprene, 10 Dichlorostyrene, rosin soap emulsification, salt acid coagulation, 55 to 65 Mooney, PBNA stabilizer.

High styrene GR-S types can be eliminated because of their greater compression set and drift characteristics as well as poorer low temperature properties. Copolymers of butadiene and chlorostyrene have shown increased flex life in tire tests. Two types are suggested for investigation, XP-36c, and XP-39 which are described as follows:

XP-36c: 71 Butadiene, 29 Monochlorostyrene, fatty acid soap emulsification, salt acid coagulation, 62 Mooney, PBNA stabilizer.

XP-39: 71 Butadiene, 29 Dichlorostyrene, fatty acid soap emulsification, salt acid coagulation, 63 Mooney, PBNA stabilizer.

The chlorostyrene polymers are not recommended for low temperature applications, but may be of considerable interest for other specific applications.

The XP-polymers described are also under development for other CPA Consulting Technical Committees. Arrangements are being made to forward on a no-charge, express prepaid, basis, ten-pound samples of X-141 and X-281, and five-pound samples of XP-36c, XP-39, XP-64, XP-65 and XP-66 to the committee members who indicated a desire for these polymers during this meeting. It should be noted that several of these XP-polymers are now being prepared and will not be available as soon as the others.

These samples are being forwarded on a no-charge basis to facilitate and expedite investigations using synthetic rubber, and with the understanding that recipients will cooperate with OTC-CPA and Rubber Reserve by reporting results of tests to Rubber Reserve. Any improvements which are suggested may be helpful. To be of greatest value, this report should treat specific properties rather than a general indication that a polymer is relatively better or worse than GR-S. This information will be used in determining whether further improvements can be made in our efforts to develop superior types of synthetic rubber.

If additional quantities of XP-polymers are required in small amounts, it is suggested that application be made to the Sales Division of the Office of Rubber Reserve for a purchase permit. However, it should be noted that sufficient quantities of the XP-polymers are not likely to be available for factory trials. The X-polymers described herein are available in unlimited quantities. A brief description of these polymers follows:

X-141: 75 Isoprene, 25 Styrene, rosin soap emulsification, alum coagulation, 60-70 Mooney, PB NA stabilizer.

X-281: Polyisoprene, rosin soap emulsification, salt-acid coagulation, 45-55 Mooney, PBNA stabilizer.

R. E. HARMON

Meeting of the Hard Rubber Consulting Technical Committee. Held: January 15, 1947. Government Presiding Officers: A. R. Miller (CPA), L. A. Woerner (ORR). Acting Chairman: C. P. Morgan (Vulcanized Rubber).

The Rubber Reserve representatives were informed at the outset that analogies to soft rubber compounding and processing may be unfounded in consideration of the problems encountered in the use of synthetic rubbers for making hard rubber. This was particularly apparent when it was reported that compounded Mooney viscosities of from 15 to 28 were commonly obtained using a raw polymer GR-S having Mooney viscosity range of 50 to 60. This appeared to be due to the large quantities of oils and sulfur used in hard rubber compounding.

Results obtained on evaluated GR-S type hard rubbers were reported as follows:

1. Moderate to low elongation—3 to 5 per cent reported with 6 per cent or over desired.
2. Poor uniformity, especially at high sulfur concentrations—most likely a matter of dispersion of compounding materials. Dispersion trouble occurs at times in Banbury mixing but rarely in mill mixing.
3. Poor flow characteristics in molding. (GR-S-60 or X-344 will improve this factor).
4. Poorer machineability than crude ebonites due probably to embrittlement and possibly to the lower elongations.
5. Poor extrusion on low compounded-Mooney compounds. Very soft crude compounds might exhibit similar characteristics.
6. Excellent cold flow, i.e., low heat distortion.
7. High tensiles obtainable with proper compounding, up to 10,000 psi.
8. Can be compounded to take high polish. (No reclaim should be used if high polish is desired).
9. High hardness (moderate hardness preferred).
10. Does not make as good semi-hard rubber compounds as desired.
11. By proper choice of polymer very low water absorption characteristics compared to natural rubber may be obtained.
12. Low hot tear resistance on semi-cures.

It was also stated that higher compounded-Mooneys were desired to avoid blistering during cure and to aid in processing. In the hard rubber product properties, Rubber Reserve was advised that elongation reflects resilience and tensile product (tensile strength times elongation) indicates the degree of impact resistance.

Comparatively little development and evaluation work had been performed on the various special purpose and experimental GR-S polymers. However, one report was received on the properties of the following special purpose GR-S ebonites. In these descriptions over 9,000 psi tensile value was rated excellent; 4-5% elongation, good; 90-105 Rockwell HR, good; 105-115 Rockwell HR, high; and values of over 116 Rockwell HR, extremely high.

GR-S-65, a very low water absorption polymer, had high tensile, good elongation and high hardness.

GR-S-16, (formerly X-272), a rosin soap polymer having a Mooney range of 95-105 and very low water absorption, had excellent tensile strength, good elongation and extremely high hardness.

GR-S-85, similar to standard GR-S except for its higher viscosity (100 Mooney) had excellent tensile, good elongation and high hardness.

An experimental butadiene-dichlorostyrene copolymer was reported to have excellent tensile strength, good elongation and good hardness, (91 Rockwell HR—¼" ball).

General recommendations by which the processibility and the physical properties of the end-product may be improved by judicious choice of the best GR-S polymer include:

A. Low water absorption: GR-S-65, GR-S-16, GR-S-10AC, GR-S-20AC, and other alum (AC types) coagulated polymers.

B. Improved processing and flow characteristics: GR-S-60 and X-344 both straight and in blends with other GR-S polymers.

C. Improved elongation: It is expected that blends of X-141 and X-281 may prove to be of exceptional interest. This may also improve machinability and embrittlement.

From the very excellent results reported by the German hard rubber industry, the Committee may desire to evaluate German Buna S-3 and a Rubber Reserve counterpart, X-349. Both of these polymers are the heat softening type. These may be obtained in small quantities upon application to the Office of Rubber Reserve, Sales Division.

As a result of the very encouraging results particularly with regard to hardness on the butadiene-dichlorostyrene polymer, 5-pound samples each of pilot plant experimental polymers XP-36C, a 71/29 Butadiene/monochlorostyrene (62 Mooney) and XP-39, a 71/29 Butadiene/dichlorostyrene (63 Mooney) will be forwarded to Committee members in the near future.

In an attempt to improve synthetic ebonites as well as prepare a GR-S type rubber from which an improved hard rubber dust may be made which will compare more favorably with natural hard rubber dusts, a crosslinked terpolymer of isoprene, styrene and divinylbenzene will be manufactured as XP-64. As a control polymer, XP-65 will be made the same as XP-64 except that the divinylbenzene will be omitted. In response to a general Committee request, XP-63, polybutadiene, is being prepared to determine its properties in hard rubber ebonites.

Five-pound samples of each of the above XP-polymers will be distributed to the Committee members as soon as they are prepared with the understanding that their evaluation will be expedited and that a complete report will be forwarded to Rubber Reserve.

GR-S hard rubber dusts were reported to act like a filler rather than as an extender and processing aid. GR-S dust is both easier and cheaper to grind and has a granular appearance compared to the amorphous-like structure of crude rubber dust. It is thought that the thermoplasticity of crude rubber and its ability to depolymerize under heat and mastication reflect chemical properties which are associated with its superior properties when used as a dust.

It would, therefore, appear reasonable that the isoprene polymers X-141 and X-281, which have been found to have similar aging characteristics to natural rubber, should make a better hard rubber dust than the other butadiene/styrene polymers. Ten-pound samples of X-141 and X-281 will be distributed to the Committee for development work on hard rubber dusts as well as ebonites.

On hard rubber products which have been limited in crude rubber content by the R-1 order, the Committee indicated that most advantageous use of the crude rubber could be made by using it as a hard rubber dust.

Rubber Reserve feels that sufficient indications have been exhibited which, upon thorough evaluation of the polymers discussed, will lead to superior synthetic hard rubber compounds. R. E. HARMON

Article on So-Lo Works

An interesting article on the operations of the So-Lo Works, Loveland, Ohio, and particularly on the management philosophy of Joe J. Marx, president and general manager of the company, appeared in the January 15, 1947, issue of *Modern Industry* under the title "He Moved His Plant to the Country." Why the plant was moved from Cincinnati and how sales and profits have been increased are some of the subjects treated with in the article.

Bid Made for Neoprene Plant

The War Assets Administration has disclosed that a bid of $13,200,000 has been made by E. I. du Pont de Nemours & Co. for the neoprene plant it has operated for the government at Louisville, Kentucky. The bid was exclusive of $3,600,000 worth of current inventories of raw and storage materials on which an additional bid is expected to be made. Only one other bid was made for the plant. It came from George F. Kinkhead, representing unnamed principals of St. Louis.

G-E 7028 Bonding Agent

A new vinyl-phenolic composition, designed for use in cementing metal to metal, and metal to various synthetic and treated rubbers, glass, cellulosics, and a variety of porous and non-porous materials, has been developed by the General Electric Co., Pittsfield, Mass. Designated as G-E 7028, the composition is also recommended as a tough chemical and moisture resistant surface coating. Because of high temperature resistance, long aging, and high bonding strength, it is said to be superior for bonding laminations.

Acquires Extruded Metals, Inc.

Detroit Gasket & Manufacturing Co., 12640 Burt Road, Detroit, Mich., has acquired Extruded Metals, Inc., Belding, Mich., manufacturer of extruded aluminum and brass alloys. John L. Barrett, formerly president of Extruded Metals, Inc., has been named a director and vice-president of the Detroit Gasket concern in charge of the Extruded Metals Division.

ADVISORY COMMITTEE PROPOSES HOLDING LINE ON CONSUMPTION

No increase in the present rate of natural rubber consumption should be permitted until certain "uncertainties" are resolved, the Rubber Industry Advisory Committee told the Civilian Production Administration at a meeting held in Washington, D. C., on February 7. Because of these uncertainties the committee advised against any early revision of Rubber Order R-1. The major uncertainties outlined by the committee included the following:

1. Whether or not the Congress will extend the power to control rubber usage beyond the present termination date of March 31, 1947.

2. Whether the public purchase of rubber will be continued beyond March 31, 1947.

3. How much natural rubber the government will have for sale to industry, and at what price it will be sold, after industry has purchased the block of 150,000 long tons of natural rubber which the Reconstruction Finance Corporation is now selling at 25¾ cents a pound.

4. Whether the price of synthetic rubbers will be reduced by the government and if so, when and how much.

All future planning, including the proposed consumption rate of natural rubber, must be based on the answers to these four major questions, committee members said. The committee expressed belief that controls on rubber usage should be continued after March 31, 1947. Various members expressed hope that the Congress would decide this question promptly to end uncertainty as to what new rubber materials may be consumed beginning April 1.

The committee was divided on continuation of public purchase of natural rubber, although a majority of members urged that government purchase be continued at least through the second quarter of 1947. Others urged that private purchase be permitted beginning April 1.

In a statement approved by the committee, members said it was "the sense of the meeting" that the rubber manufacturing industry had not bought natural rubber for import into the United States in the second quarter of 1947, and would refrain from doing so unless restrictions on rubber imports were lifted effective March 31. It was pointed out that such purchases would impede the government's first quarter purchase program by competing against it.

The committee asked for government announcement of a firm policy as to price and quantity of natural rubber to be sold after disposal of the 150,000 long tons of 25¾ cent rubber purchased last June. Expressing belief that the prices of synthetic rubbers could be reduced, the committee asked for a statement of policy on this subject without delay.

(EDITOR'S NOTE: On the price question, Presidential Assistant John R. Steelman advised RFC Chairman Henderson on February 7 that it would only be necessary to redetermine rubber pricing policy if usage controls are terminated or if RFC's stocks are reduced to 160,000 tons. He further stated that when the latter situation develops, RFC should sell at a price that would definitely discourage further purchases from the stockpile.)

The committee said that a detailed study of the supply and requirements situation for natural rubber in 1947 must await the answers to some, at least, of the "four major uncertainties." General discussion covered the Rubber Study Group at the Hague, which in November estimated that about 650,000 long tons of natural rubber would probably be available to the United States from 1947 world production. With the carry-over from 1946 purchases, potential 1947 supply was estimated at 770,000 long tons.

It is essential to increase working inventories of natural rubber to normal prewar levels and to make provision for emergency reserves, CPA said. Consequently, it was estimated that about 500,000 long tons of natural rubber will be available under favorable conditions, for consumption in 1947.

The 1947 requirements of the rubber manufacturing industry have been estimated at 1,003,000 long tons of new rubber materials, exclusive of reclaimed rubber. Therefore, American-made rubber must supply the rest of the requirement, or about 500,000 long tons of GR-S, butyl, neoprene and N-types rubbers.

Special problems arising through lack of natural rubber latex and pale crepe were outlined to the committee by W. James Sears, government presiding officer, who forecast that continuation of special controls currently in force will be necessary throughout 1947 to allocate the limited supplies equitably to manufacturers in whose operations these special types are essential.

GOODYEAR MODERNIZES WORLD'S LARGEST TRUCK TIRE ROOM AT AKRON

According to the Goodyear Tire & Rubber Co., the world's largest truck tire room is maintained at its Plant One in Akron. This room, which stretches out for a quarter mile and has a rated capacity of 10,000 units per day, was recently modernized, including new arrangement and placement of machinery, installation of scientifically planned lighting that is practically shadowless, and new flooring for a considerable portion of the approximately 170,000 square feet of floor space. Each of the tire building machines is allotted an area 20 feet by 22 feet. The room contains 134 of these machines, valued at more than $1,000,000. All equipment, including the conveyor lines and industrial trucks, is operated electrically, some 350,000 watts of electricity being required to provide energy for the department. The conveyor system used to carry tires from the building machines to the pits for vulcanization is 3,750 feet in length. In an average working day, more than 500,000 pounds of compounded rubber, fabrics and steel wire beads are converted into truck tires in this one room. Currently in operation 24 hours daily, approximately 1,600 workers are employed in the room.

Seiberling Building Destroyed

An explosion followed by a flash fire destroyed the cement building of the Seiberling Rubber Co. in Barberton, Ohio, on February 18. Static electricity from a belt was said to have set off the blast which caused damage estimated at $25,000 but no injuries. The company expects to maintain production by obtaining cement from other rubber manufacturers until its own facilities are replaced.

VILES AND HOLT ADDRESS CONNECTICUT RUBBER GROUP

The Winter Meeting of the Connecticut Rubber Group, held at the Monogram Hall of the General Electric Co. in Bridgeport, Conn., on February 14, and attended by approximately 100 members and guests, featured a symposium on natural rubber. A. L. Viles, president of the Rubber Manufacturers Association, discussed "Various Types of Crude Rubber," while E. G. Holt, rubber advisor of the United States Department of Commerce, spoke on "The World Supply Situation of Rubber." At a business meeting following the symposium, the by-laws of the Group drawn up by the Executive Committee were officially accepted by the membership.

Mr. Viles, the first speaker, who took as his topic "Various Types of Crude Rubber," first traced the developments which led to the adoption of the now standard R.M.A. types. This adoption, he stated, stemmed from the time the Association took on the difficult task of acting as allocation authority for natural rubber during World War I. At that time no standards were established.

As a result of its close association with crude rubber during this period, the Association recognized the need for such standards and worked out a program with the Rubber Trade Association of New York which was finally adopted in 1928 despite opposition from some quarters. The standards, which stressed cleanliness rather than technical aspects, were readily accepted by the rubber producers. Samples of the present standards were displayed by the speaker.

During the concluding portion of his address, Mr. Viles briefly outlined the growth in applications of rubber during the past few decades in which he has been associated with the rubber industry. In closing, he re-emphasized his opposition to resumption of regulations or controls over the production and distribution of natural rubber.

In his talk, Mr. Holt pointed out that supplies of natural rubber are now fairly well distributed through world pipelines, with end-1946 stocks at 238,000 tons in the United States, 164,000 tons in the United Kingdom, an estimated 50,000 tons in France, and 148,000 tons in Malaya, while stocks afloat were approximately 200,000 tons as compared with less than 100,000 tons a year earlier.

The outlook for world production of 1,200,000 tons of natural rubber in 1947, as estimated by the Rubber Study Group, is supported by information on the rate of production and shipments in recent months, according to Mr. Holt. The Study Group has estimated 1947 world consumption at 1,700,000 tons, of which 720,000 tons for foreign countries is possibly a high estimate. Some 200,000 tons of the foreign demand is expected to be supplied by synthetic rubber, leaving a calculated foreign demand for 520,000 tons of natural rubber.

Using this estimate, if the stocks of natural rubber in foreign consuming countries were to be the same at the end of 1947 as at the end of 1946, there would theoretically be 680,000 tons of natural rubber available for sale to the United States this year. At the moment, stocks are being moved from England to America, nearly 28,000 tons having arrived in January.

It was estimated by Mr. Holt that in 1947 approximately two-thirds of the natural rubber supplies will come from natives and small-holders, and one-third from estates over 100 acres. The shortage of high-quality estate grades of rubber is expected to continue through 1947, and until estates in Sumatra and Java are accessible for company-directed operations.

Concentration of Trading

The concentration of rubber trading in countries under British jurisdiction in 1947 will amount to about 85 percent of the supplies compared with 65 percent before the war, the speaker said. In addition to the production in British areas, their trade in Malaya extends over the imports into Malaya from the Netherlands Indies and Siam. A substantial share of the 1947 exports from the Netherlands Indies under Dutch jurisdiction is already committed in barter arrangements between the Netherlands and European countries.

Temporary guidance over Government policy in respect to rubber reverted to the Office of War Mobilization and Reconversion under Mr. John Steelman, upon the resignation of Mr. William Batt as Chairman of the Inter-Agency Policy Committee on Rubber, and the disbandment of that Committee. Through the President's Messages of February 3 and February 10 to Congress, the questions of continuance of controls over rubber and the establishment of a long-range rubber policy have now been placed before the legislative branch of the Government.

Akron Group Hears Strohm

Approximately 450 members and guests attended the Winter Meeting of the Akron Rubber Group, held at the Mayflower Hotel in Akron on February 21, making it the largest winter meeting in the Group's history. John L. Strohm, formerly editor of the *Prairie Farmer* and more recently president of the American Association of Agricultural Editors, was the principal speaker at the meeting. His topic was "The People Behind the Iron Curtain." In his talk, Mr. Strohm stated that the Russian people do not want war, that they admire and are grateful to America for her help in the war effort, and are as bewildered as we when they read in the Russian press reports of America's belligerent intent. The future peace of the world depends upon better understanding between the common people, the speaker declared. There would be no war if all diplomacy were on a common people basis.

CHICAGO RUBBER GROUP HEARS TALKS BY MIGHTON AND STANGOR

Dr. C. J. Mighton and E. L. Stangor, of the Akron Rubber Laboratory of E. I. du Pont de Nemours & Co., Inc., were the principal speakers at the February Meeting of the Chicago Rubber Group, held at the Hotel Morrison in Chicago, Ill., on February 14. The program also featured the presentation of a movie of the 1946 championship football game between the Chicago Bears and the Chicago Cardinals.

In his talk on "New Outlets for Rubber Through Latex," Dr. Mighton traced the development of new products from natural rubber latex, covering the period from the original uses of latex for dipped goods, proofings, and adhesives, to the development of latex foam sponge and latex-bonded fibers. During the war, natural latex was replaced by the synthetic latices, opening new fields for the use of latex because of the better properties which can be obtained by using the synthetics.

As manufacturers are able to increase their production, the speaker stated, they will have more opportunities to produce tailor-made latices with special properties to suit specific requirements. Research on latices is continuing at a fast pace and new developments may be expected in the near future.

Speaking on "Backrinding of Molded Rubber Products," Mr. Stangor described the causes of the torn or gouged condition which occasionally occurs at or near the mold parting line of a vulcanized cylindrical slug or rectangular block. The sudden release of internal pressure resulting from thermal expansion of the compound forces the vulcanized rubber past the sharp edges of the parting line, thereby gouging a piece out of the finished article.

Mr. Stangor indicated that backrinding can be reduced by using the proper amount of compound in relation to the mold cavity, increasing the amount of inert filler, increasing the fillers with lower thermal expansion, curing at lower temperatures, and preheating the unvulcanized stock. Cooling the mold under pressure was reported to be a solution which can be used frequently because of the longer time involved. Proper design of the molds to eliminate distortion when the mold is opened was also recommended.

California Meets March 20

The March meeting of the Northern California Rubber Group will be held on Thursday, March 20, at Angelo's Restaurant in Emeryville, Calif. The speaker will be E. E. Gullekson, of the California Research Corporation, who will deliver an address on "Butyl Rubber."

The Chicago branch of the Heyden Chemical Corp. is now located in more spacious offices at 20 North Wacker Drive. F. A. Degener is in charge of the office.

MEETING OF BUFFALO GROUP FEATURES ADDRESS BY CLARK

The February Meeting of the Buffalo Rubber Group, held at the Hotel Sheraton in Buffalo, N. Y., on February 25, featured a talk by Dr. C. C. Clark, of the Mathieson Alkali Works, Inc., on "Dichlorostyrene Rubber." Horace W. Carpenter, Jr., vice-president of the Buffalo Senior Chamber of Commerce, also addressed the Group, describing the work of the Chamber and some interesting sidelights of the Industrial Niagara Frontier.

An abstract of Dr. Clark's talk follows herewith:

Dichlorostyrene rubber was developed by the Mathieson Alkali Works in 1942 and tested by the General Tire & Rubber Co. in the Akron Government Plant in 1944 and 1945. Early work showed good heat resistance and special adaptability of this rubber to heavy-duty truck tires. Practical tests indicated that dichlorostyrene rubber is one of the best synthetic rubbers for tires that came out of the war rubber program.

The rubber is made by copolymerizing dichlorostyrene with butadiene by emulsion polymerization methods. The copolymer can be compounded into a variety of formulae, one of the GR-S type being most generally used. Hard rubber compositions can also be obtained by varying either the amount of sulfur or the content of the dichlorostyrene in the crude rubber.

When a composition of the GR-S type is used, best results are obtained with a 30-40% content of dichlorostyrene. Milling characteristics are excellent. The crude rubber breaks down and compounds more rapidly than GR-S.

Comparisons on the basis of tensile strength, elongation, moduli and hardness, tested cold and hot, aged and unaged, show that dichlorostyrene rubber is superior to GR-S. Superior resistance to flex cracking is demonstrated on the Goodrich flexometer and in actual road tests. Dichlorostyrene rubber is more resistant to moisture absorption than natural rubber and more resistant to oil than either natural rubber or GR-S.

The dichlorostyrene monomer is available for experimental purposes. On an equal scale of manufacture, it is estimated that dichlorostyrene rubber would cost less than 10 per cent more than GR-S.

Changes at Rubber Reserve

W. R. Hucks, who has been associated with the Office of Rubber Reserve, Reconstruction Finance Corporation, for the past few years, most recently as production manager, has been named deputy director in charge of the production division. John T. Cox, Jr., has been made administrative officer and production manager, while M. J. Tierney will act as assistant production manager.

Latex Bibliographies Wanted

Volume 1 of the Marchionna bibliography on latex and rubber derivatives, entitled "Latex and Its Industrial Applications,' is now entirely out of print. Copies of Volumes II and III, however, are still available. Since many purchasers of the latter two volumes are anxious to secure the first volume in order to complete the set, we would like to secure several copies of Volume 1. We will pay $10.00 for each copy of Volume I returned to us in good condition. Returned copies should be addressed to: Book Department, RUBBER AGE, 250 West 57th St., New York 19, N. Y.

SOUTHERN OHIO RUBBER GROUP HOLDS ITS INITIAL MEETING

The initial meeting of the recently organized Southern Ohio Rubber Group was held at the Young Women's League Auditorium in Dayton, Ohio, on February 20, with approximately 160 members and guests in attendance.

The featured speakers at the meeting were George R. Vila, sales manager for latex, Lotol, and dispersions of the Naugatuck Chemical Division of U. S. Rubber Co., who spoke on "Growth of the Latex Industry in the United States," and Dr. Charles J. Mighton, manager of the Akron Rubber Laboratory of E. I. du Pont de Nemours & Co., Inc., who discussed "Neoprene Latices—Their Development and Use."

In his talk, Mr. Vila traced the development of the American latex industry, employing slides which illustrated its evolution statistically. Dr. Mighton, the second speaker, gave a short history of the development of neoprene and neoprene latex, and went into some detail on the various uses of neoprene latex.

Harry E. Outcault, vice-chairman of the Division of Rubber Chemistry, A.C.S., also addressed the Group. He spoke briefly on the organization of various rubber groups, and complimented the Southern Ohio Group on the quality and size of its initial meeting.

Zupan Hi-Lo Lubricant

A new lubricant, which is said to be particularly applicable to various types of sealed bearings, twister rings, universal joints, and gears, has been developed by Yanda Industries, 6819 West Hemlock Road, Independence, Ohio. Known as Zupan Hi-Lo Temperature Grease, the lubricant is a synthetic oil constituent which is said to never gum, harden, or oxidize and to be non-corrosive. Light tan in color, it can be applied directly through high-pressure guns or compression cups.

TALK BY SCHOENFELD FEATURED AT MEETING OF DETROIT GROUP

Dr. Frank K. Schoenfeld, vice-president and technical director of the B. F. Goodrich Chemical Co., Cleveland, Ohio, was the principal speaker at the Winter Meeting of the Detroit Rubber and Plastics Group, held at the Detroit Leland Hotel in Detroit, Mich., on February 28, and attended by approximately 125 members and guests. At the meeting, J. P. Wilson, chairman, announced that the next meeting of the Group will be held at the Detroit Leland Hotel on May 16. The members of the Group voted for a summer outing including a golf tournament and clam bake to be held the latter part of June.

Speaking on "Status and New Developments on GR-S Rubber," Dr. Schoenfeld declared that although natural rubber on the whole is slightly superior to the synthetic product, we will have in the future a series of new rubbers for specialty applications, which will perform superior to natural rubber.

If synthetic rubber can not compete on quality, it may well be able to compete in price, the speaker stated. Synthetic rubber can be produced for fifteen to seventeen cents per pound, including all costs and a modest profit. The price of natural rubber is more uncertain. Although natural rubber could be laid down in New York Harbor for eight to ten cents per pound without outside control or profit, it is unlikely this will happen. Such factors as availability of labor in the Far East, political developments, and government regulation will undoubtedly require that the natural product be sold for more than the synthetic.

Although the price of natural rubber is increased by the higher wage demands of the native on the plantation, Dr. Schoenfeld pointed out, countermeasures of a large labor pool in this area, and the fact that 50% of the rubber trees are native owned, may bring the price down. Also, high yield trees which were planted before the war are now ready for tapping.

In discussing the future of the synthetic rubber plants, the Goodrich Chemical official expressed the hope that government permit private industry to control these plants, and that research and development continue in this field, with the new discoveries made by private industry being protected according to our patent system.

Products and Services Booklet

The 1947 edition of the booklet, entitled "New Products and Services," has been made available by the *New York Journal of Commerce*, 63 Park Row, New York 15, N. Y. Containing over 850 of the latest products and services being offered by 627 firms this year, the booklet provides names and addresses of manufacturers and an index of manufacturers and products. Copies of this booklet, the second on post war innovations issued by the business newspaper, are available at 50c per copy.

NAMES IN THE NEWS

WILBUR A. YOUNG, formerly plant manager of the M. W. Parsons Co., has been appointed service and sales engineer of the Metallic Soap Department of the Warwick Chemical Co., Division of the Sun Chemical Corp.

ROBERT B. WETSEL, who has been associated with the B. F. Goodrich Co. since 1935, most recently as sales engineer on the company's rubber-lined equipment, has been named manager of Anode sales by the company. He will handle sales of all industrial products made directly from latex by the Anode process.

VINCENT R. REBAK, connected with the New York Sales Division of Miles Laboratories, Inc., since his release from the Army, has joined the New York sales organization of the Heyden Chemical Corp. He will handle the company's accounts in upper New York State as well as Cleveland and Akron, Ohio.

KENNETH W. GREEN, who has served as assistant purchasing agent of the Electric Storage Battery Co., Philadelphia 32, Penna., for several months, has been appointed purchasing agent for the company, succeeding the late WILLIAM B. GOLD.

JOHN B. TOWER, executive assistant to the president of U. S. Rubber Export Co., Ltd., retired from active duty with the company on March 1, after more than forty years of service with the U. S. Rubber organization.

W. F. TWOMBLY, formerly assistant director of the Chemicals Bureau of the War Production Board and previously associated with E. I. du Pont de Nemours & Co., Inc., for fifteen years, has been appointed technical director of the Witco Chemical Co., New York City.

S. R. DANIELS, formerly associated with the research division of the E. J. Kelly Co., has joined the technical staff of Hewitt-Robins, Inc., at Buffalo, N. Y.

J. F. DOWNIE SMITH, associated with the research activities of the United Shoe Machinery Corp. for the past several years, has left that organization and is now at Iowa State College, Ames, Iowa, as Director of the Iowa Engineering Experiment Station and Director of the Engineering Extension Service.

F. PARKER BARTLETT, JR., who has been associated with the Union Paste Co., Hyde Park, Mass., for the past several years as a chemist and sales engineer, has been made technical director of the company.

ALBERT H. KAHN, president of the Acme Rubber Co., has been named chairman of the National Rubber Division of the United Jewish Appeal, which will participate in a nation-wide campaign to raise $170,000,000 for refugees, overseas needs, and Palestine.

DR. S. I. STRICKHOUSER, assistant plant manager of the Providence, R. I., plant of the U. S. Rubber Co. since 1945, has been appointed manager of that plant, succeeding M. G. BURNETT, who has been appointed consultant on the staff of ERNEST G. BROWN, vice-president and general manager of the mechanical goods, general products and Lastex divisions.

W. H. STEWART, formerly purchasing agent of the Pennsylvania Rubber Co., has been appointed director of purchases for Textron, Inc., New York City. MR. STEWART has seen service with Goodyear and during the war was closely connected with the WPB Textile Division in Washington.

LEROY T. BARNETTE, branch office supervisor of the cellulose products department of the Hercules Powder Co. since 1945, has been appointed manager of plastics markets of that department.

WILLIAM E. RAND, formerly general manager of the pigments division of the Sun Chemical Corp., has been named assistant director of the Stanford Research Institute, Stanford University, Calif. He will also act as project manager for the National Rubber Research Project being conducted by the Institute for the Office of Naval Research.

FREDERICK C. WISSEMANN, who has been associated with the Witco Chemical Co., New York 17, N. Y., since 1937, having started as office manager and accountant, has been appointed assistant treasurer of the company.

MELVIL E. CLARK, formerly director of market research for Wyandotte Chemicals Corp., Wyandotte, Mich., has been named sales manager by the company for soda ash, caustic soda, and bicarbonate of soda.

HARRY P. SCHRANK, vice-president in charge of production of the Seiberling Rubber Co., Barberton, Ohio, has been elected head of the Akron Area Council of Boy Scouts.

REV. DALE D. DUTTON, pastor of a Baptist Church, has become associated with the Bristol Manufacturing Co., Providence, R. I., as "Vice-President of Christian Relations."

Announce Enlarged Sales Program

W. D. Anderson

Owen J. Brown, Jr., general sales manager of Godfrey L. Cabot, Inc., has announced that W. D. Anderson, head of the Cabot Akron Office, has been appointed Director of the Akron Territory in an enlarged sales program which includes the carbon black selling efforts of Herron Bros. & Meyer, Akron Office. Herron Bros. & Meyer, long exclusive agents for General Atlas Carbon Company, an affiliate of the Cabot company, will continue to sell their regular lines of clays and other commodities to the rubber industry and in addition offer Cabot as well as General Atlas products to the trade. Representatives of Herron Bros. & Meyer will also join in the sale of Cabot products in certain specified locations in other parts of the country. Mr. Anderson opened the Akron Office of Godfrey L. Cabot, Inc., in 1941 and has remained there since in charge of sales in that area.

HARVEY S. FIRESTONE, JR., president of the Firestone Tire & Rubber Co., has been appointed chairman of a fund raising campaign, sponsored by the Thomas Alva Edison Foundation, to keep alive and active the genius exemplified in the life, accomplishments, and ideals of Thomas A. Edison.

JOHN L. MEAD, associated with the General Tire & Rubber Co., Akron, for the past 19 years, has been appointed director of industrial relations. At one time he was production superintendent of the General Tire plant at Wabash, Indiana.

HAROLD QUINBY, sales manager of the I. B. Kleinert Rubber Co., New York, has been elected president of the National Notion Association.

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MICRONEX BEADS

WHEN carbon black was first made for tires in 1912 it was packed as a light fluffy powder. Handling in the rubber plant was difficult and dusty. Improvements involving compression of the black, while helpful, did not eliminate these problems.

In 1927 the discovery of Dustless Micronex opened up an entirely new approach. Again Binney & Smith had pioneered in the field of improved carbon blacks for the rubber industry. It soon became evident that not only was dust virtually eliminated in bag shipments, but also the carbon mixed into rubber faster and produced good dispersions.

Now known as Micronex Beads this product is the standard of cleanliness and flowability. This position has been earned by virtue of uniformity of bead size, spherical shape, freedom from dust and strength sufficient to withstand the rigors of bulk handling.

STATEX-B *The carbon for dynamic reinforcement*

STATEX-93 *The carbon for heavy-duty reinforcement*

FURNEX
The high resilience carbon

●

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NEW POLYMERS AUTHORIZED BY OFFICE OF RUBBER RESERVE, RECONSTRUCTION FINANCE CORPORATION

Listed below are types and properties of new experimental GR-S polymers (including GR-S latices) which have been authorized by the Office of Rubber Reserve, Reconstruction Finance Corporation, since publication of those listed in our last issue. Procedures for the distribution and sale of these polymers will be found in our October, 1945, issue.

X Number	*Manufacturing Plant*	*Date of Authorization*	*Polymer Description*	*Special Characteristics*
X-359 GR-S Latex	U. S. Rubber, Naugatuck	1/23/47	GR-S latex with a 55/45 B/S ratio 58% solids minimum.	Similar to Type III latex except for slight increase in BD content. Slight formula changes to facilitate production. General purpose high solids latex.
X-360 GR-S	General, Baytown	1/27/47	GR-S masterbatch containing 100 parts GR-S with 52 ± 2 parts HMF black; Mooney viscosity of unpigmented polymer 40 ± 5.	Similar to GR-S Black I with HMF used in place of 50 parts EPC Black. Material available in quantities for experimental and development work only, due to limited production capacity. Continued supply cannot be expected in the near future.
X-361 GR-S	Goodyear, Akron	2/11/47	Low water absorption GR-S; 50-60 Mooney, alum coagulated.	This polymer is being prepared for electrical insulation for wire and cable. Might be of interest in applications where very low water absorotion is required. Reported to have water absorption characteristics similar to deprotenized rubber (2.24 mg/cm² after 9 days immersion at 70°C). Order for experimental quantities up to 200 lbs. should be addressed to Mr. W. H. Aiken, Chemical Products Division, Goodyear Tire & Rubber Co., Akron, Ohio. However, reports should be submitted as is customary—the Research & Development Div., Office of Rubber Reserve, 1626 "K" St. N.W., Washington, D. C.
X-362 GR-S	U. S. Rubber, Naugatuck	2/14/47	71/29 BD/S made with a non-staining antioxidant (1.5 IBUL), glue-acid coagulation.	Non-staining variation of GR-S-65. Expected to have faster rate of cure than GR-S-65 which is a low water absorption polymer.
X-363 GR-S	U. S. Rubber, Naugatuck	2/14/47	71/28.5/0.5 BD/S/Divinyl-benzene, glue-acid coagulation, IBUL, 58 ± 8 Mooney.	Non-staining, low water absorption variation of GR-S 60 (formerly X-285 GR-S). Expected to be faster cure than GR-S 60, and similar rate of cure to X-344.
X-367 GR-S Latex	Firestone, Akron	2/10/47	Same as Type III Latex except that Rosin Acid soap is used; 37-39% solids, soap content 3.5 — 3.9 on latex.	A high soap Type III GR-S latex. Expected to have better mechanical stability. May produce more stable blends with natural rubber.
X-368 GR-S	Goodrich, Port Neches	2/20/47	GR-S-10 type polymer made by continuous polymerization; Mooney 50-58.	Slight formula changes to facilitate production. No differences expected in physical or chemical properties.

A new flexible hose strongly reinforced to withstand pressure of 800 pounds per square inch has been developed by U. S. Rubber for use on high pressure auto washer equipment. The hose is reinforced with two plies of Ustex.

Curtis Automotive Devices, Inc., 8 Norwood Ave., Dayton 7, Ohio, has introduced a new device, called the Curtis Spare Tire Inflator, which makes it possible for a spare tire in an automobile trunk to be checked and inflated without opening the lid.

Sturdy new rivets made of Plexiglas, the transparent acrylic plastic, capable of being used in the fastening of rubber, leather, cardboard, light metals, and other materials, have been developed by the Douglas Aircraft Co., Santa Monica, Calif.

The general offices and all manufacturing facilities of the O'Neil-Irwin Manufacturing Co. have been moved to Lake City, Minnesota. Expanded production of the company's Di-Acro precision benders, brakes and shears is planned.

Over one hundred mechanical rubber goods products manufactured by the company are featured in a new wall show case displayed at the entrance to the executive offices of the H. O. Canfield Co. at 444 Madison Ave., New York City.

A static eliminator has been developed by Goodyear to keep the effect of static in radio receiving sets below the level where it can interfere with an incoming signal. The eliminator has been installed at several of the ground reeciving stations of United Air Lines.

FINANCIAL NEWS

NET INCOME OF $23,207,941 REPORTED BY U.S. RUBBER CO.

U. S. Rubber Co. has reported a net income of $23,207,941 for 1946, which is the highest in the company's history. After allowing for $8.00 a share on the preferred stock, this was equal to $10.23 a share on the common stock, and compares with a net income of $13,024,778, or $4.44 a common share, in 1945. Consolidated net sales for 1946 also reached a new high, amounting to $494,753,028, an increase of 4.9% over sales of $471,506,473 for the previous year, which had been an all-time high up to that point.

The three synthetic rubber plants which the company operates for the government produced a total of 289,000,000 pounds of various types of synthetic rubber with a value of more than $47,000,000. This amount was in addition to the consolidated net sales as reported. The net income of $1,423,004 received in connection with these operations was included in other operating revenue.

The company's extensive natural rubber plantations situated in Malaya, which had been written off in 1941 and 1942 as war losses of $9,530,562, were recovered by the company in 1946. Appraised at $5,513,690, this investment was restored to the books of the company at $3,418,488 after providing for the payment of Federal income tax of $2,095,202. The $3,418,488 was added to general reserve pending determination that the stability of political and economic conditions warrants the assumption that this is a sound value. The company has not been able to recover its plantation properties in Sumatra, which were written off as war losses of $10,023,006 in 1942, or to ascertain their physical condition because of political unrest in the Netherlands East Indies.

Direct taxes of $62,366,782 were charged against operations in 1946, as compared with taxes of $47,025,988 for 1945. The company also forwarded to the government a total of $19,387,623 as income and social security taxes paid by its employees.

During the year, the company sold $40,000,000 of 2⅝% debentures dated May 1, 1946, and due May 1, 1976. Annual sinking fund redemptions will begin May 1, 1957, at the rate of $2,000,000 until maturity. The $27,000,000 of outstanding ten-year serial notes bearing interest at the rate of 2% were paid in full on June 27, 1946, under a credit agreement giving the company the right to borrow amounts ranging from $25,500,000 at this time to $21,000,000 on June 27, 1948. With the continuing expansion of business, the company expects to borrow all or part of these funds during 1947.

The consolidated balance sheet as of December 31, 1946, indicated current assets of $187,151,930, against current liabilities of $68,668,142, giving a net working capital of $118,483,788, which compares with $110,070,924 for the previous year, an increase of $8,412,864. Total inventories at the end of the year amounted to $101,086,716, against $84,449,011 at the end of 1945. Foreign assets of $35,006,468 showed an increase of $13,659,727, accounted for primarily by increased activities in Canada, Latin America, and the plantations.

Additions to property and plant during the year totaled $24,080,637, exclusive of rubber plantation properties. Deductions including depreciation and disposals and adjustments amounted to $8,448,676, leaving a net increase of $15,631,961.

Three additional plants were purchased during the year, including the government built plant at Fort Wayne, Indiana, which was acquired for the production of industrial rubber products, particularly automobile parts other than tires; part of a government war plant at Milan, Tennessee, which was bought for the production of canvas rubber-soled footwear; and the combed yarn plant of Ruby Cotton Mills, Inc., at Gastonia, North Carolina. Two additional plants were leased during the year, one at Newport, Rhode Island, to supplement golf ball production, and another at Washington, Indiana, for the making of protective clothing.

An average of 61,499 employees excluding those on the Far Eastern plantations, received a total of $182,652,076 in wages and salaries in 1946, an average of $2,970 per employee. This compares with $183,488,762 paid the previous year to 70,739 employees, an average of $2,594 per employee.

At the end of the year, there were 24,478 holders of common and preferred stock, which compares with 23,322 at the end of 1945. No single stockholder, individual or corporate, was said to own more than 2.7% of either class of stock.

During the year, reconversion from war to peacetime objectives of the company in research and development was reported to have been successfully completed. Added emphasis was given to fundamental research, and an intensive program was undertaken to find more peacetime applications of the new war-developed materials.

To carry out these programs additional laboratories were made necessary. At Naugatuck, Connecticut, a new chemical laboratory for the Naugatuck Chemical Division is expected to be ready in the near future, while at Mishawaka, Indiana, the Footwear Division completed a laboratory to carry out expanded programs in the plastics field.

MOHAWK RUBBER CO. REPORTS NET INCOME OF $1,044,689

Net income of $1,044,689 for 1946, after deducting all charges including $100,000 for a reserve account to meet any contingencies resulting from an expanding research program and $714,847 for Federal income taxes, has been reported by the Mohawk Rubber Co. This is equal to $7.38 per share, and compares with a net income of $343,970, or $2.43 per share, for the previous year. Net sales in 1946 amounted to $10,088,446, which compares with $7,857,399 in 1945, the previous high for the company.

The consolidated balance sheet as of December 31, 1946, indicated total current assets of $2,979,240, including $1,093,327 in cash, $900,501 in trade accounts receivable, and $977,443 in inventories. Total current liabilities were reported as $476,487, including $393,494 in accounts payable and $30,064 in accrued expenses and local taxes.

At the close of 1946, the working capital of the company was $2,502,753, representing an increase of $579,715 over the previous year, and the ratio of current assets to current liabilities stood at 6.25 to 1. During 1946, $335,143 was spent by the company for plant improvements. These improvements were part of a program needed to rehabilitate machinery and equipment continuously used during the war years.

Flintkote Company, Inc.

For 1946: Net income of $3,710,723, which is equal to $2.81 each on 1,183,921 common shares, and which compares with $1,643,285, or $1.32 each on 1,033,921 common shares, for 1945. Net sales amounted to $52,579,605 against $37,023,416 for the previous year. Renegotiation of 1945 war profits with the Navy Price Adjustment Board indicated that no refund to the government was required, and the provision of $40,000 made then was restored to 1946 income.

Dewey & Almy Chemical Co.

For 1946: Net income of $719,967, which is equal to $2.16 each on 307,215 common shares after payment of dividends on preferred stock prior to its redemption on July 31, 1946, and which compares with $600,138, or $1.69 a share, before war-end adjustments for the previous year. Net sales for 1946 reached a new high of $12,575,436, an increase of 14% over the 1945 total.

Pharis Tire & Rubber Co.

Year Ended October 31: Net income of $1,562,714, which is equal to $3.68 a common share, and which compares with $145,192 for 1945 after $386,865 was deducted for accelerated amortization of emergency facilities. Net sales amounted to $19,914,141, against $13,174,678 for the previous year.

GOODYEAR TIRE & RUBBER CO. REPORTS NET OF $36,211,784

Goodyear Tire & Rubber Co. has reported a net profit of $36,211,784 for 1946, the largest in the company's history, which is equal to $16.07 a common share, and which compares with $15,136,816, or $5.87 a common share, for the previous year. Sales amounted to $616,508,162, which compares with $716,176,748 in 1945, the last year of wartime business, and with $330,599,674 in the previous peacetime record year of 1941.

The consolidated net income reported for 1946 is after providing $15,000,000 in reserves, including $5,000,000 for foreign investments, because of increasing regulations abroad which may have adverse effects on the company's foreign values, and $10,000,000 for possible cost and price adjustments and other post war contingencies.

In common with many other companies during the first-year of post war reconversion, Goodyear made heavy capital expenditures during 1946. The expansion and improvement of productive facilities, both here and abroad, required new capital commitments of $43,000,000 of which $32,600,000 were installed by the end of 1946. The company expects that substantial additional amounts for similar purposes will be necessary in 1947.

Working capital of the company at the end of 1946 amounted to $174,500,000, which compares with $152,472,000 at the end of the preceding year. Current assets were $223,190,673, against current liabilities of $48,630,459, a ratio of 4.6 to 1.

Net income of $9,860,000 was contributed by the company's foreign subsidiaries and included in consolidated net income for 1946. Foreign investments owned by the company and consolidated in the year-end balance sheet amounted to $38,000,000, which included approximately $8,800,000 of cash representing working capital of the company's various foreign interests required in the course of business.

A statement accompanying the report reviewed the activities of the company at home and abroad during the year. Abroad, production was started at the company's new tire and mechanical goods factory in South Africa, and the capacities of its Canadian, Mexican, and Peruvian factories were increased. At home, Goodyear increased facilities for the production of tires and mechanical goods, and of the vinyl raw material plant at Niagara Falls, N. Y.; started construction of a plastics laboratory and synthetic pilot plant at Akron; provided machinery for the manufacture of vinyl plastics; and expanded the rayon facilities of its southern textile mills.

The company continued to operate three government-owned synthetic rubber plants on a fee basis at Akron, Houston, and Los Angeles. The status of its tire factory at Buitenzorg, Java, and the rubber plantation in Sumatra remained undetermined.

Monsanto Chemical Co.

For 1946: Net income of $10,084,149, after taxes and all charges, which is equal to $2.37 a common share, and which compares with $5,318,003 or $1.16 a common share, for the previous year. Net sales of the company and its consolidations, exclusive of British and Australian subsidiaries, aggregated $99,590,790, or 4% higher than the $95,339,391 volume for 1945. As of December 31, 1946, current assets amounted to $73,571,871 and current liabilities to $12,239,124, compared with $43,901,713 and $7,140,587, respectively, at the end of 1945. Reflecting higher costs and increased operations, inventories totaled $17,984,778 against $14,397,944 at the end of the previous year.

United Carbon Co.

For 1946: Net income of $3,010,284, after providing for taxes, contingencies, and all charges, which is equal to $7.57 a share, and which compares with $2,263,867, or $5.69 a share, for the previous year. Sales amounted to $22,312,818, an increase of 54.3% over the 1945 volume of $14,458,738. According to the report, sales of carbon black accounted for 74.3% of the 1946 total, natural gas 22.3%, and crude oil and other products 3.4%. An increase of 36% in carbon black sales to 317,616,000 pounds was attributed to an unprecedented demand from domestic rubber manufacturers and larger export markets.

Brown Rubber Co., Inc.

For 1946: Net income of $361,728 after providing for taxes, which is equal to $1.44 a share on the 251,000 outstanding shares, and which compares with $196,866, or 78c a share, for the previous year. During the year the company invested $139,947 for new buildings, machinery, and equipment, and retired its mortgage with the Smaller War Plants Corporation and all bank loans. As of December 31, 1946, total current assets stood at $955,696 against total current liabilities of $446,755, providing a working capital of $508,941, the highest in the company's history.

Monroe Auto Equipment Co.

Six Months Ended December 31: Net income of $406,271, which is equal to 93c a share on common stock after payment of preferred dividends, and which compares with a deficit of $216,329 in the corresponding period of the previous year.

New Jersey Zinc Company

For 1946: Net income of $5,496,938, which is equal to $2.80 a share, and which compares with $5,161,243, or $2.63 a share, for the previous year.

O'Sullivan Rubber Corp.

For 1946: Net income of $251,333, which compares with $328,386 for the previous year.

B. F. GOODRICH CO. REPORTS NET INCOME OF $25,207,871

Consolidated net income of $25,207,871, after provision for estimated Federal and foreign income and excess profits taxes and after providing reserves of $5,500,000 for contingencies and $5,000,000 for anticipated property obsolescence, has been reported by the B. F. Goodrich Co. for the year of 1946. After allowing $5 a share on the preferred stock, this is equal to $17.69 a common share, and compares with a net of $12,313,501, or $7.84 a common share, in 1945.

Consolidated net sales of the company amounted to $361,471,149, highest total for any peacetime year in the company's 76-year history and only 2.9% below the all-time peak of $372,082,813 set in 1945. The production of American-made rubber from government-owned plants operated by the company was not included in sales for either year.

A long-range program which called for the rehabilitation and expansion of production facilities and which had been interrupted by the war is going forward, according to a statement which accompanied the report. The program includes expansion in the chemical and plastic fields, and the creation of a new research center, projects which are being financed from the company's earnings. A tire manufacturing plant at Tuscaloosa, Ala., which the company had started to build for the government early in 1945 as a war plant, and which it later purchased from the government was completed and before the end of 1946 had begun production of tires and tubes.

B. F. Goodrich Chemical Co. was reported to have expanded its operations during the year. A surplus war plant at Louisville, Ky., was purchased for the increased production of Geon resins to meet constantly broadening demand, and operations were begun in a semi-works plant at Avon Lake, Ohio, for the development and testing on a semi-commercial scale of new chemical materials, processes, and techniques.

The report noted that the company's plastics products division is constructing a new plant at Marietta, Ohio, for the manufacture of a wide line of Koroseal products, and revealed that this plant would be put into operation in 1947. The company's aeronautics division leased and equipped a plant at Troy, Ohio, for the manufacture of the company's expander-tube brakes and airplane wheels. During the year, progress also was reported on the five principal buildings of the company's new research center at Brecksville, Ohio, midway between Akron and Cleveland.

The consolidated balance sheet as of December 31, 1946, indicated current assets of $146,778,955, including cash of $10,811,316 and inventories of $78,531,128, and current liabilities of $33,451,077. At the end of 1945, current assets were $129,477,241, of which cash was $15,050,438 and inventories $54,975,826, while current liabilities stood at $23,217,233.

LOS ANGELES NEWS

The Twentieth Anniversary Meeting of the Los Angeles Rubber Group was held on February 4 at the Mayfair Hotel in Los Angeles. It was also the first meeting of the 1947 season and attracted one of the largest attendances in years, with some 175 members and guests present.

The dinner and meeting was preceded by the regular meeting of the Technical Group, in charge of W. J. Thomas (Firestone). The guest speaker was Ross E. Morris, senior rubber technologist at the Rubber Laboratory of the U. S. Naval Shipyard, Mare Island, Calif. Mr. Morris spoke on "Weather Aging of Synthetic and Natural Rubber." During his talk he detailed the weather aging processes and the establishment of a test for compound evaluations from this standpoint.

At 7:00 P.M. the members met for a delicious steak dinner, after which the program for the evening was underway. In the absence of the Group's chairman, Curtis Wolter (U. S. Rubber), Phil Drew (Goodyear), associate chairman, wielded the gavel and opened the meeting with the introduction of new members.

Gaelen K. Norton (Kirkhill Rubber), chairman of the Current Events Committee, related the local news of the rubber industry and personnel changes. Bob Short (Kirkhill) followed with the presentation of the Group's Yearbook and thanked the members for their splendid cooperation in publishing the 1947 Twentieth Anniversary Edition of the book.

Phil Drew recalled some of the achievements of the Group and called on the past chairmen present at the meeting. C. M. Reinke (Reinke & Amende) noted the financial progress of the Group. A. L. Roese (Goodyear) told how the Tlargi Yearbook has become a standard reference book for the local rubber industry. Gaelen K. Norton (Kirkhill) related the initial Board meetings and the Group's efforts during the war. Ed L. Royal (H. M. Royal) spoke of the formation of the Board of Directors. Arthur F. Pond (U. S. Rubber) praised the chairman, Mr. Drew, and the members for their great progress.

The final speaker, among the past chairmen, was Dr. Raymond B. Stringfield (Fullerton) who was one of the founders of the Group. He also emphasized the great strides made by Tlargi members.

The main speaker of the evening was Dr. Russell H. Fitzgibbon, Associate Professor of Political Science, U.C.L.A. Dr. Fitzgibbon addressed the Group on the timely subject, "Argentina, Problem Child of the Americas." The hope was expressed that in the not too distant future the forces of democracy would eventually triumph in Argentina. Despite the present control by President Peron, and his military clique, there are strong undercurrents of democratic sentiments among the mass of the people.

Prior to World War I the country was controlled by the great land-owning class. Afterwards the military leaders banned together to achieve an intermittent control of the government. Dr. Fitzgibbon related how the issuance of the American Blue Book before the Argentina National Elections inadvertently helped elect Peron because of the peoples' misinterpretation of the U. S. meddling in Argentine affairs. It was noted that the only course for the U. S. at present was a policy of caution and patience.

After the main talk of the evening, Phil Drew called a recess, and then announced that a golf tournament would be held at the San Gabriel Country Club on March 14th. Before the members left, a variety of door prizes were given to holders of lucky numbers.

Construction of a unit for premixing carbon black into synthetic latex has been started by U. S. Rubber at the plant it operates for the government in the Torrance district of Los Angeles. The new unit will blend between 2,000,000 and 2,500,000 pounds of rubber per month, with the entire production to be allotted to rubber manufacturers on the Pacific Coast.

Active management of the Sarrail Rubber Co., manufacturers of rubber cements and adhesives, is now in the hands of Harold A. Sarrail, son of the company's founder, Edward P. Sarrail, who passed away last year. Originally established in 1924 as a recapping firm, the company gradually turned toward the manufacturing end and abandoned recapping activities in 1935. New mixing machinery, to the tune of some $5,000, was recently installed. Charles Molnar, who has been with the company since its inception, continues as general manager.

Note: A meeting of the Los Angeles Rubber Group was held on March 4. A full report will appear in our next issue.

Quebec Holds Ladies Night

A record number of members and guests attended the annual "Ladies Night" meeting of the Quebec Rubber & Plastics Group, held at the Ritz Carlton Hotel in Montreal, Quebec, on February 12. Douglas Walkington, of Canadian Industries, Ltd., Montreal, was the principal speaker of the evening. His subject was "New Yarns for Old." Added features of the evening were a fashion show, with ten professional models displaying the latest in new fabrics, the presentation of a film, entitled "The Fabric of Our Story," and dancing. In his talk, Mr. Walkington pointed out that the evolution of synthetic fibres has brought many dyeing problems to the textile industry. There are numerous dyes on the market today, he said, because most dyes are not effective on one or two fibres, and even in the same fibre, there is a need for different fastness properties. In discussing flame-retarding fabrics, Mr. Walkington said that no permanent economical treatment for garments has yet been developed, since the present chemical treatments are too easily removed during laundering. However, in several instances fire-retarding fabrics were said to have proven valuable as protective clothing for industrial workers.

Among those present at the Twentieth Anniversary Meeting of the Los Angeles Rubber Group, held on February 4 at the Mayfair Hotel in Los Angeles, Calif., were, left to right: Ross E. Morris (Mare Island Navy Yard); Phil Drew (Goodyear); and Dr. Russell H. Fitzgibbon (U.C.L.A.).

Zemaitis Joins Burlington Mills

J. F. Zemaitis

Joseph F. Zemaitis, who has been associated for the past ten years with the Naugatuck Chemical Division of the U. S. Rubber Co. and Dispersions Process, Inc., in charge of development work on water dispersions of natural and synthetic rubbers, has been appointed vice-president and technical director of Burlington Mills, Inc., Burlington, Wisc. A graduate of Rensselaer Polytechnic Institute, Mr. Zemaitis has specialized in the commercial development of dispersions for tire cord treatments, adhesives, saturants, hair and fibre cushions, carpet constructions, coatings and related applications of natural and synthetic rubber and plastics.

Guayule Production in Russia

According to reports in the Soviet press, the rubber processing factory recently built in Azerbaidzhan will be able to process 1,000 metric tons of guayule a year, indicating a yearly output of 100 metric tons of pure rubber. The plant was expected to process 300 metric tons of guayule during the late months of 1946. Considerable increase in guayule acreage is said to be planned for the next few years, as well as the construction of an additional large rubber processing factory. In Azerbaidzhan, the number of guayule bushes per acre averages between 4,000 and 6,000, each bush weighing 1 to 1.2 kilograms (2.2 to 2.6 pounds). Of the different varieties of guayule, *Pioner Karabakha* has been reported the most productive.

Kelite Products, Inc., Los Angeles, is manufacturing a new fast working matrix cleaner which is available in two types: Kelite Formula 304, which is brushed on, allowed to stand for about three hours and then brushed off, and Kelite Formula 304E, which is used in a matrix tank.

Inflatable Furniture

Inflatable furniture was one of the features of the Welsh Industries Fair recently held in London, England. The furniture is made of the fabric used for barrage balloons and rescue dinghies. On exhibit were chairs, including armchairs, which are collapsible and which can be carried in a zipper-fastened carrier bag.

Buys Additional Textile Units

U. S. Rubber Co. has purchased the textile plants of the Stevens Manufacturing Co. and Seaboard Mills, Inc. in Burlington, N. C. The new facilities will be used by the company for the production of a wide variety of new fabrics, including fire-resistant decorative fabrics and Strex, the all-textile elastic fabric made without rubber. More than 250 persons are employed at the two plants, which contain 216 looms suitable for a wide range of special fabrics up to 68 inches in width. R. M. Mitchell will be in charge of local operations in both plants, and F. C. Phillips will serve as general superintendent. Acquisition of these two plants by U. S. Rubber increases to three the number of plants owned by the company in Burlington.

Goodyear Develops New Ink

Goodyear Tire & Rubber Co., Akron, has developed a new fast-drying printing ink which is said to represent a radical departure from previous products in the printing field. The new development for the printing industry is prepared by grinding together a new synthetic resin of the Pliolite type and the desired pigment. The mixture is then dispersed in a solvent, making a pasty mass that resembles conventional printing inks in consistency and appearance. When the ink is used in printing, the pressure of the press squeezes the solvent out of the resin, permitting the resin to dry as soon as what little solvent remains evaporates. Goodyear plans to manufacture the resin only, selling it to ink manufacturers for the final steps in compounding the ink.

Fisk Safti-Flight Tire

The Fisk Safti-Flight automobile tire, which uses stripes of white rubber to form a flexible tread designed for quick stops, is again being produced by the U. S. Rubber Co. Introduced to the public just prior to the war, the tire was withdrawn from the market during the war years. New postwar features of the tire are a tread of thicker depth than usual to provide long mileage and, in the larger sizes, the use of improved rayon cord. Quick stopping is made possible by the white rubber stripes which cut across the tread, creating hundreds of independently acting tread blocks.

Woythaler Heads Hodgman Rubber

M. I. Woythaler

M. I. Woythaler, treasurer and general manager of the Hodgman Rubber Co., Framingham, Mass., has been elected president of the company, succeeding A. W. Wechsler, who was named chairman of the board of directors. Mr. Woythaler joined the company in 1919, was elected treasurer in 1926, and became general manager in 1931. The company also has announced the election of Herbert Bremner as assistant treasurer.

Second Annual Foundation Lecture

Dr. Philip Schidrowitz, well-known British chemist, has been selected as the principal speaker at the second annual Foundation Lecture of the Institution of the Rubber Industry, to be held on June 6 at the Connaught Rooms, Great Queen St., London, England. Dr. Schidrowitz will talk on "The Impact of Synthesis on the Rubber Industry." He will not confine his address to synthetic rubbers, but will also discuss plastics and other relevant materials. The broad question of natural rubber versus, or in relation to, man-made materials will receive consideration and reference will be made to the possibility of fusion or closer relationship between the rubber and plastics industries.

Production and sales of its Seal-O-Matic puncture-sealing safety tube, interrupted five years ago by the war, has been resumed by Goodrich. A gum-like rubber compound inside the tube under the tread and shoulder areas of the tire surrounds and grips tightly puncturing objects so that no air escapes.

The general sales offices of both the DoAll Company and the DoAll International Company, general distributors of DoAll products and machine tools, have been moved into new quarters at Des Plaines, Illinois.

CANADIAN NEWS

Major achievements of the Polymer Corporation, which marked the fifth anniversary of its incorporation by the Canadian Government last month, were outlined early this month by E. R. Rowzee, director of the company's research and marketing activities, in the fourth of the series of popular scientific lectures sponsored by the Sarnia (Ontario) Board of Education and the Sarnia *Canadian Observer*.. The Polymer Corporation was organized on February 14, 1942.

After reviewing some of the achievements in the past five years, including the production of 78,000,000 pounds of synthetic rubber (Buna S and butyl) in 1944, 102,000,000 pounds in 1945, and 114,000,000 pounds in 1946, Mr. Rowzee discussed the present and future work of the organization. He revealed that at present Polymer is turning out four basic types of GR-S in solid form, five experimental types; and three basic types of GR-S latex. In addition, it is also turning out three types of butyl and two experimental types, one used principally for a purpose not yet disclosed and the other for electric wiring which requires a high resistance to ozone.

Mr. Rowzee also indicated that Polymer will soon be turning out two additional types of GR-S latex, one of which shows great promise for use in foam sponge, as well as a brand new material to be produced in the low temperature polymerization equipment of the butyl unit. This new material, he said, shows unusual promise for the packing and storing of citrus fruits. A nitrile type rubber which has outstanding resistance to petroleum and other solvents has also reached the pilot plant stage.

A three-day "Conference on Radiochemistry" has been arranged to take place at McMaster University on May 15, 16 and 17 under the auspices of the National Research Council and the Chemical Institute of Canada. A number of informal morning and afternoon sessions have been planned during which ample time will be reserved for discussion. A comprehensive exhibition of instruments and literature is also being planned. Further information can be secured from Dr. R. V. V. Nicholls, Department of Chemistry, McGill University, Montreal.

Net income of the Goodyear Tire & Rubber Co. of Canada and its subsidiaries for 1946 has been reported at $1,660,013, which is equal to $5.40 a share on common stock, and which compares with $1,385,959, or $4.30 a share, excluding a refundable tax of $176,258, for the previous year.

Gross profit for 1946 before depreciation and income and excess profits taxes, but after a special provision of $500,000 toward possible future decline in raw material prices, amounted to $5,070,240, against $4,851,607 the year before. Depreciation of $683,951 in 1946 compared with $1,608,973 in 1945, and income and excess profits taxes of $2,726,276 compared with $1,856,675 including the refundable tax of the previous year. Earned surplus at the end of the year stood at $8,184,851 against $8,096,432 a year ago.

According to the report, new expenditures for additions in 1946 amounted to $1,722,707, representing mainly cost of additional equipment and facilities for anticipated production requirements of lines presently being manufactured and for the manufacture of new products. Further heavy expenditures in 1947 are contemplated by the company to complete the program of extension and modernization. Two new factories at New Toronto, Ontario, were said to be nearing completion.

The consolidated balance sheet as of December 31, 1946, disclosed current assets of $12,564,996 and current liabilities of $3,290,497, indicating net working capital of $9,274,499, which compares with $9,526,558 at the end of the previous year.

Representatives of the sales and service organization of the tire division of the Dominion Rubber Co., Ltd., met in Kitchener, Ontario, last month for a two-week series of conferences. Principal meeting of the conference was a three-day factory refresher course, in which tours of the company's tire factory were conducted, followed by discussion sessions. The program for the first several days included a tour of the company's rubber machinery shops, a luncheon and a sales training course on the subject of farm tires.

In his annual report as Auditor-General of Canada, Watson Sellar recently criticized some of the transactions of the War Assets Corporation. Mr. Sellar observed that contracts for automobile tires and tubes were continued after contracts for vehicles had been cancelled with the end of mutual aid. The goods were declared surplus assets. The tire contracts were amended later to delete the inspection clause, apparently at the insistence of the WAC, he revealed, and no certificate was produced during the audit to establish that deliveries were in accordance with contract.

At a meeting held in Toronto, Ontario, on February 9, the directors of the Canada Wire & Cable Co., Ltd., decided to take no action on the company's Class A and B common dividends. Declaration of regular quarterly dividends of $1 on Class A would normally have been announced at the meeting. The previous payment of $1 was made on December 16, 1946. Class B stockholders received 25c quarterly up to September 15, 1946. Failure to take action on these dividends at the meeting, according to the company, is entirely a reflection of the strike at the plant last fall.

Canadian Resins & Chemicals, Ltd., has announced plans to enlarge its Vinylite resin manufacturing facilities at Shawinigan Falls, Quebec, and to construct a new plant for the production of dioctyl phthalate (DOP). Both the extension and the new plant are expected to be in operation by the summer of 1948.

GR-S Production Being Reduced

Based on the rising tide of natural rubber imports, production of synthetic rubber in government-owned plants is gradually being reduced. Output of GR-S for March was reduced to 47,000 tons as compared with the 50,000 produced in February. Although small, the reduction is indicative of a trend which is expected to bring more drastic cutbacks in the last six months of the year. The Goodyear-operated plant in Akron has been virtually shut down, with the plant's latex production being continued on a limited basis. The Firestone-operated plant in Akron is being reduced to an economical minimum, with the emphasis on latex. Cutbacks in production have also been ordered at the U. S. Rubber-operated plant in Naugatuck, Conn., and the plant in Louisville, Kentucky, operated by the National Synthetic Rubber Corp.

Oils for Rubber Tests

Through the cooperation of the Enjay Co., Inc., and the Sun Oil Co., two of the standard petroleum base oils to be used in connection with A.S.T.M. tentative methods D-471-46-T have been made available. These oils, designated as No. 1, low swelling, aniline point 124°C, and No. 3, high swelling, aniline point 70°C, have been cross checked in a cooperative program among several laboratories and each oil has been found to be within the required tolerance of plus or minus 1.8° F. on aniline point. The methods covered are Tentative Methods of Test for Changes in Properties of Rubber and Rubber-like Materials in Liquids.

N. Y. Sets Outing Date

The 1947 summer outing of the New York Rubber Group will be held on Friday, June 20, at Blasberg's Grove, Hawthorne, N. J., the site of the last outing. Plans are now being formulated to make the outing an enjoyable event for all. Pete Murawski (DuPont) is again acting as Chairman of the Outing Committee.

OBITUARIES

Eric C. Gyllensvard

Eric C. Gyllensvard, export and New York office manager of Farrel-Birmingham Co., Inc., was killed on February 17, when struck by lightning in Sao Paulo, Brazil, while on a business trip to South America. Mr. Gyllensvard was born in Sweden and after going to preparatory school in Switzerland entered Cambridge University in England, from which he received his B. S. degree in mechanical engineering in 1927. After graduation he was connected with the Standard Oil Co., first as petroleum engineer, and later as sales engineer for the company's subsidiaries abroad. He later joined the Sullivan Machine Co. as export manager, handling the company's extensive export operations for seven years prior to joining Farrel-Birmingham. During the war years, Mr. Gyllensvard served in an advisory capacity on various government committees in Washington handling export controls. He was formerly president of the Machinery & Metals Export Association. A widow and daughter survive.

Albert E. Caldwell

Albert E. Caldwell, executive vice-president and general manager of the Atlas Supply Co., Newark, N. J., died in the New York Hospital in New York City on February 15 after a brief illness. He was 57 years old. Mr. Caldwell was formerly associated with the Continental Rubber Co., Erie, Penna., and the Fisk Rubber Co., Chicopee Falls, Mass. With the Atlas Supply Co., he was an originator of the practice of selling automobile tires at gasoline service stations, which has spread throughout the United States and Canada. He belonged to the Union League Club in New York City and the Essex Club of Newark, N. J. A widow survives.

J. Harry Clo

Dr. J. Harry Clo, head of the research department of A. Schrader's Son—Division of the Scoville Manufacturing Co., Brooklyn, N. Y., died in a hospital in Waynesville, N. C., on February 22 at the age of 65. He went to Waynesville last October for his health. A former member of the faculties of the University of Kentucky, Washington State College, Tulane University, and the University of Pittsburgh, Dr. Clo was credited with developing a number of oxygen valves used on equipment for the armed forces during the war. He held a Ph. D. degree from the University of Chicago.

Hugh A. Galt

Hugh A. Galt, formerly vice-president of the Pittsburgh Plate Glass Co., died of pneumonia at his summer home in Ventnor, N. J., on February 24. He was 79 years old. Mr. Galt retired as vice-president of Pittsburgh Glass in 1941 after serving in that capacity since 1920. Arriving in this country from Scotland at the age of 21, his first job was with Harrison & Co., chemists, in Philadelphia, Penna. Later he founded the first caustic soda plants in Michigan, Ohio, and Texas. A widow and daughter survive.

Charles F. Marble

Charles F. Marble, treasurer of the Curtis & Marble Machine Co., died at his home in Worcester, Mass., on February 7 after a long illness. He was 81 years old. Born in Worcester, Mr. Marble was graduated from Amherst College in 1886 and became associated with his father in the machine company, where he was made a director in 1895. A widow, daughter, and son survive.

New British Abstract Journals

Three new abstract journals of general interest to the rubber manufacturing field recently made their appearance. These are: (1) *Abstracts of the British Plastics Federation,* issued by the Federation, 47-48 Piccadilly, London W. 1, which covers all the known journals dealing with plastics and a number of others; (2) *British Chemical Digest,* published by British Chemical Digest, Ltd., 14 The Avenue, Beckenham, Kent, which is a review of chemical progress throughout the world and which reproduces full articles in addition to abstracts; (3) *Index Aeronauticus,* issued by the British Ministry of Supply, Thames House, Millbank, S.W. 1, a review of technical information pertaining to aeronautics in general. Specific information concerning any or all of these three new abstract services can be secured by writing direct to the publishers as listed above.

Standard Develops A-Resin

A synthetic resin derived from petroleum, which promises good results when used as a base for rubber adhesives, textiles, and footwear, has been developed by the Standard Oil Co. (New Jersey). Called A-Resin, the substance is said to have excellent qualities of adhesion, flexibility, and wetting power which particularly fit it for use on surfaces difficult to paint with ordinary paint. Designed to the specifications of the paint and varnish industry, the resin can be applied to iron, brass, bronze, aluminum and highly polished metal as well as wood and steel.

Plantation Riots in Malaya

Rioting among Indian laborers on several rubber plantations in Kedah, northernmost of the Malay states, was reported last month. According to official reports from Kuala Lumpur on March 2, the situation has been brought under control, although further difficulties may arise. The rioting is attributed to political motives rather than as the result of strikes seeking grievance settlements. The first postwar purchase of Malayan rubber by Russia was reported from Singapore on February 12, 4,000 tons having been purchased by Russian representatives. It was announced on February 24 that an increase from 2.75 to 3.10 Straits cents per pound in the export duty on rubber had been put into effect. The new rate is 5% ad valorem plus a fourth of a cent applied to the present fixed rubber price of 41.78 Straits cents per pound.

Mexican Restrictions Removed

The rubber supply situation in Mexico was eased sufficiently during the latter part of 1946 to allow the removal, by decree, of numerous restrictions that were in effect during the war period, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. Limitations were removed on the use of rubber for the manufacture of general products; on production and sale of tires and tubes and the proportion of the output of truck to passenger car tires; and on price, sale conditions, and distribution of tires and tubes to the public. The restriction imposed in 1943 against the installation of new factories or the expansion of existing plants was likewise removed.

Insulators for Jolt Machines

Rubber insulators have been developed by the U. S. Rubber Co. to isolate the vibrations of jolt machines used to make sand molds in foundries. The insulators are being used for the first time to mount thirteen machines, weighing 3,000 to 22,000 pounds, in the foundry of the aircraft engine plant of the Wright Aeronautical Corp. in Woodridge, N. J. Each machine is secured to a large concrete block which rests on the rubber mountings. The rubber is said to isolate shock so completely that sensitive instruments in a research laboratory less than fifty yards from the machines can be operated without interference.

Change Name of Journal

Effective with the January, 1947, issue, the name of the *Analytical Edition* of *Industrial and Engineering Chemistry* has been changed to *Analytical Chemistry.* In addition to the new name, a new format has been adopted and two new departments added, "Aids for the Analysts" and "The Analyst's Column."

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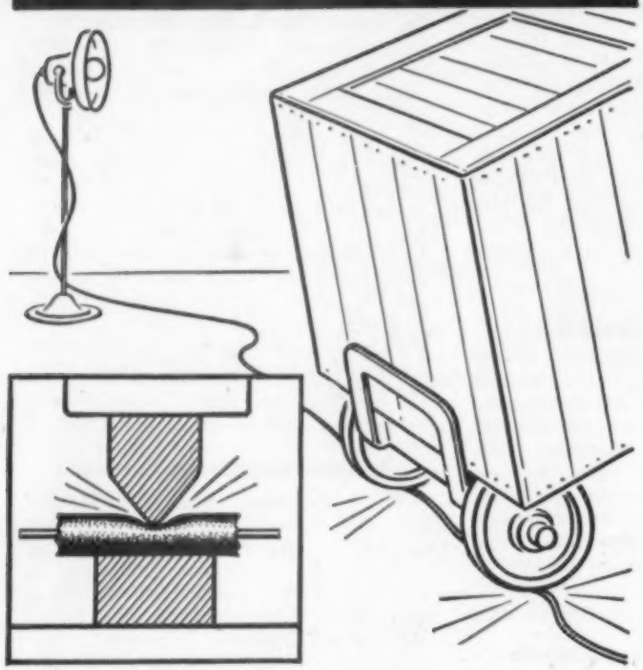

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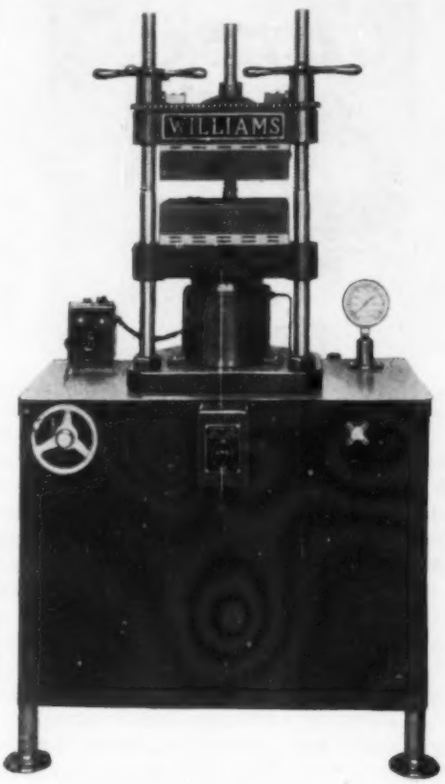
NEW EQUIPMENT

Williams Hydraulic Molding Press

A new hydraulic laminating and molding press, primarily designed for laboratory and research work on paper laminating, and for the molding of plastics and rubber parts on a semi-commercial basis, is currently being marketed by the Williams Apparatus Co., Inc., 21 Park Pl., Watertown, N. Y. The press is of a three-post design which is said to give better alignment



of the platens. The maximum opening of ten inches is instantly available, without the use of wrenches or special tools, by the vertical hand wheels which are synchronized through the use of chain and sprockets.

One of the outstanding features of the press is a hand wheel pressure control valve by which the ultimate pressure may either be pre-set, or the pressure may be gradually increased during the pressing cycle. When a pre-set pressure is desired for continuing pressing cycles, the pressure may be released through a by-pass needle valve leaving the control valve set for the next cycle.

The press develops an approximate 57 ton pressure between 12-inch by 12-inch platens by means of a motor driven hydraulic radial pump operating at 3000 p.s.i. and acting upon a 7-inch ram. The entire system is protected by a relief valve set and locked at 3500 p.s.i. After the pressing or molding is completed, working space to remove the mold is immediately available by raising the top plate the moment the high pressure is released instead of the conventional procedure of waiting until the lower platen returns to its stop.

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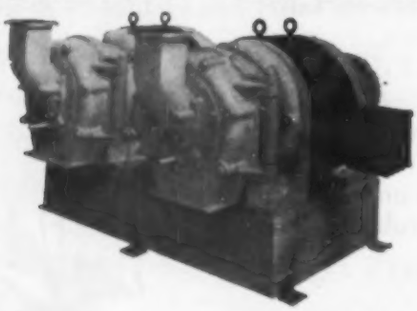

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Tire and Tube Repair Machine

A machine for repairing tires and tubes, which has been on the market in Canada for six years, has been introduced in the United States by the Allied Automotive Corp., 1729 Ford Bldg., Detroit 26, Mich. Known as "Tireweld," and equipped with an automatic time switch, the machine makes a weld of rubber that

stretches with the tire or tube. To operate, the operator sets the tire or tube on the element plates and tightens them. "The "Marktime" switch clock is then set to the amount of time required for heating. The electric current is turned off automatically when the time is up. The operator is left free to attend to other work while the weld is being made, without danger of burning the material by overheating. The complete operation requires 9½ minutes.

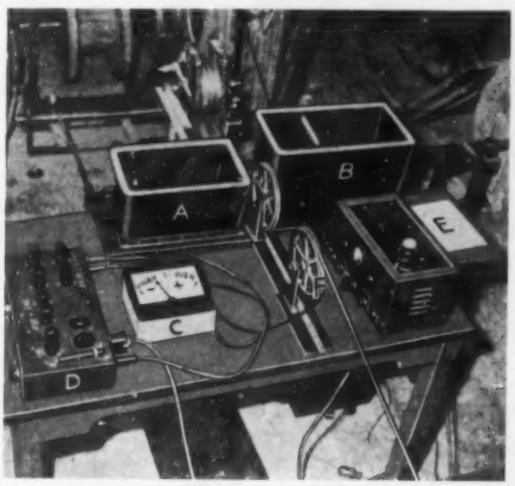
Tireweld is a low voltage unit, operating on 110 volts A.C., 25 or 60 cycle, or direct current. A cast aluminum frame with free swinging arm allows easy access to the work. The heating unit consists of a Chromalox element embedded in a special type metal plate which is said to insure even distribution of the heat. The machine is said to repair blowouts and cuts in tubes and tires, whether on the side wall, inside casing, tread, or around the valve. It is reported equally efficient on synthetic or natural rubber, and as effective on other rubber goods as it is on tires and tubes.

The **Dustex Dust Collector,** said to be an innovation in portable dust collectors, has been introduced by the Dust Filter Co., 1753 W. Lake St., Chicago 12, Ill. Unlike most tubular units which depend solely upon the filter tubes to separate the dust from the air, this unit causes the separation of high percentage of the dust at the point of intake.

Ideal Industries, Inc., Sycamore, Ill., has developed a new **"hot blade" wire stripper** for continuous production stripping. Through use of two electrically-heated stripping blades, the unit will strip cotton, silk, plastic insulation or rubber covering from fine stranded or solid conductors.

Photo-Electric Wire Diameter Gauge

As a rule, in order to meet the rigid standards for exact diameters of insulated wire, it has been necessary to apply a gauge physically to the wire. Since the coating of rubber or other material is still in a plastic condition as it emerges from the extruder, wire manufacturers are usually compelled to run the covered wire



through a trough filled with water to cool it. Sometimes considerable wire is wasted before it is discovered that the wire is not of the correct dimension.

It is now possible to measure insulated wire directly at the extruder head with the use of an electronic diameter beam gauge developed by John T. O'Connor & Co., West Orange, N. J. Freshly extruded compound on the wire or cable, still hot and tacky, is not touched by the gauge.

The O'Connor gauge is said to be accurate to within one-half of 1000ths of an inch. Features of the instrument are indicated in the accompanying illustration. The basic photo-electric gauge (A and B) can be mounted close. The meter (C) is mounted on a nearby post or machine part and can be calibrated in percentage or thousandths of an inch. The amplifier and power supply (D and E) are remotely located.

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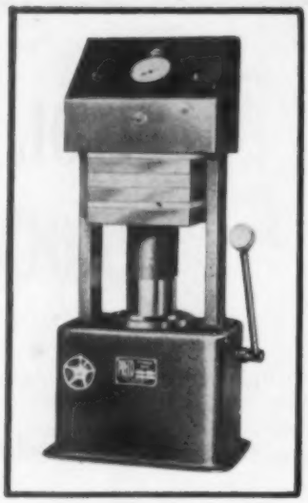

This inexpensive, proven hydraulic press is used by firms from coast to coast to do many jobs on the production line, for plant control and for experimental work. Develops a full 40,000 pounds pressure on 8"x8" or 8 3/4"x12" platens with a few strokes of the 2-stage pump. Platens open 8", and a third platen can be installed to double the platen capacity. Pressure and temperature controls are extremely accurate. Write today for complete data.

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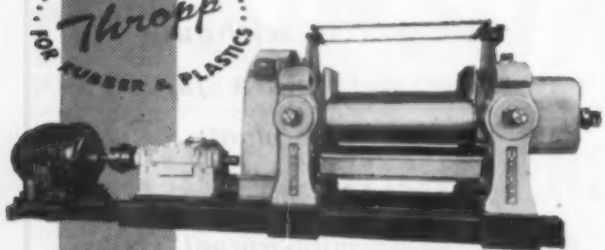

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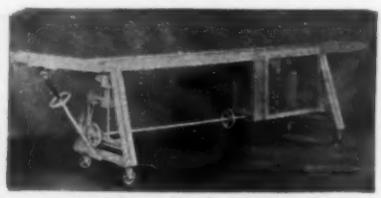
Take-Off Apparatus for Extruded Rubber

A new take-off apparatus for conveying rubber and plastics direct from extruding equipment, enabling these materials to cool sufficiently for handling, has been placed on the market by the Island Equipment Corp., 101 Park Ave., New York 17, N. Y. Known as the Plastic and Rubber Extruding Unitable, the apparatus has three control hand wheels, one for quickly adjusting the height of a 2-foot long infeed section which fits closely to the outlet of the extruder, and the other two, located in different positions, to provide convenient operating positions for the travel speed of the belt. The infeed section has an adjustable up-and-down movement of 6 inches from center, which is said to fit practically any need or condition. The two handwheels located in different positions operate on the shaft under the belt, one near the end of the machine and the other about half way up the belt, these being the two positions or stations most convenient for the operators. Longer units (up to 100 feet) are equipped with additional control wheels. The Unitable is equipped with a special belt to withstand the heat of the parts from the extruder. It is equipped with large easy rolling casters which permits it to be moved easily and quickly. It can be supplied with variable speed units from 300 r.p.m. maximum to 0 r.p.m. minimum.



A packaged remote control for use with fractional or integral h. p. motors, said to be the first time such a unit has been made available, is a new product of Yardeny Laboratories, Inc., 105 Chambers St., New York 7, N. Y. Called the **Synchro-Link**, it is a remote positioning servo control that will quickly and accurately position one or a number of distant motors according to the setting of the control transmitter.

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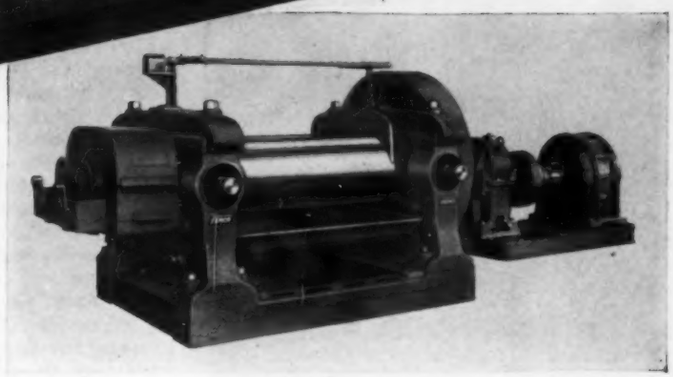
RUBBER & PLASTICS HEAVY DUTY MILLS



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REVIEWS

BOOKS

Contribution to the Physics of Cellulose Fibres. By P. H. Hermans. Published by Elsevier Publishing Co., Inc., 215 Fourth Ave., New York 3, N. Y. 5¾ x 8¼ in. 224 pp. $4.00.

This is one of the monographs in the Series on the Progress of Research in Holland, the purpose of which is to show the world that scientists in the Netherlands have remained active during the five years of German occupation. It also represents Communication No. 21 from the Institute for Cellulose Research of the AKU and Affiliated Companies, headquarters of which are located in Utrecht, Holland, and covers the outcome of experimental investigations carried out by the author and co-workers, mainly during the year of 1943.

As indicated by the title, the present monograph is basically a study in the sorption, density, refractive power and orientation of cellulose fibres. In the investigations covered by the book, special attention was paid to the influence of moisture on the optical properties and to the quantitative relations between double refraction and orientation, since, even in the case of natural fibres, hardly any fundamental information on these items was available. Furthermore, the experimental results achieved in the investigations is arranged against a theoretical background which is in conformity with the modern views on fibre structure.

The monograph is divided into two sections, theoretical and experimental. Included with the first section are some interesting x-ray studies on orientation. Also included in this section is an appendix which gives, among other data, the mathematical relation between the main polarizabilities of the fibre and the orientation of its structural elements, and the mathematical relation between the distribution of the orientation of paratropic planes and the potical constants of the crystalline material. It is to be regretted that no author or subject index is included.

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Mathematical Theory of Elasticity. By I. S. Sokolnikoff. Published by the McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. 6 x 9 in. 373 pp. $4.50.

The theory of elasticity, in its broad aspects, deals with a study of the behavior of those substances which possess the property of recovering their size and shape when the forces producing deformations are removed. This elastic property is possessed to some extent by all solid bodies, and the prime concern of the mathematical theory of elasticity, with which this book deals, is to reduce to calculations the stresses and strains in an elastic body subjected to the action of a system of prescribed external forces.

The book is divided into five chapters, the first three covering the analysis of strain, the analysis of stress, and stress-strain relations. The fourth chapter, representing the bulk of the book, is devoted to an extensive mathematical treatment of homogeneous beams under tension, torsion and flexure, while the fifth, and concluding, chapter is concerned with the variational methods which find their principal exponent in the theorem of minimum potential energy. The latter chapter contains several procedures for deducing approximate solutions of the boundary-value problems of mathematical physics, these procedures being illustrated by their application to the torsion and flexure problems.

This volume had its origin in a series of lectures given by the author in 1941 and 1942 in the Program of Advanced Instruction and Research in Mechanics, conducted by the Graduate School of Brown University. It includes author and subject indexes, as well as an appendix containing a summary of the more important formulas used in the text.

Plastics Handbook for Product Engineers. Compiled and edited by John Sasso. Published by McGraw-Hill Book Co., Inc., 330 West 42nd St., New York 18, N.Y. 6 x 9 in. 468 pp. $6.00.

This is a collection of engineering data on plastics and synthetic rubber. It presents, in concise handbook form, practical and fundamental data of specific use to the engineer planning to adopt these materials to new product designs. Special chapters on the chemistry of plastics and synthetic rubber, designed to give the engineer concise information on the chemical background of the materials, were prepared by Paul O. Powers of the Battelle Memorial Institute. Much of the remaining text has been briefed from material that originally appeared in *Product Engineering*, prepared by qualified authors. As the author points out in his preface, the book is not intended to replace the many available authoritative books and publications, but rather supplements such published data, concentrating on information specifically needed by product engineers.

The book is divided into three parts: (1) Plastic Materials; (2) Design of Plastic Products; (3) Rubber-Like Materials: Chemistry and Application. The part on rubber-like materials is sub-divided into seven chapters covering the folowing subjects: Synthetic Rubber-Like Materials, Synthetic Rubbers in Engineering Design, Butyl Rubber, Butadiene-Acrylonitrile Rubbers, GR-S Synthetic Elastomers, Neoprene Rubber, and Thiokol Polysulfide Synthetic Rubbers.

There are 15 chapters in all. In addition to a carefully cross-referenced subject index, there is a bibliography of plastics and lists of reference catalogs on plastics indexed by companies and by materials.

•

Annual Report on the Progress of Rubber Technology: 1945. Published by W. Heffer & Sons, Ltd., Cambridge, England, for the Institution of the Rubber Industry, 12 Whitehall, London, S. W. 1, England. 7¼ x 9¾ in. 120 pp. Price: To Members, 4/6 (approximately $1.25); To Non-Members, 12/6 (approximately $3.25).

The latest of these annual reports compiled by the Institution of the Rubber Industry, the ninth to be published, covers the progress of rubber technology during the year of 1945. Once again each branch of the over-all rubber field is covered by a well-qualified expert, with bibliographical references to journals and patents appearing at the end of each section. In general, the size of the various sections is about equal to that of the previous edition, covering the year of 1944, except that the section devoted to "Synthetic Rubber" has dropped from 26 pages to only 7 pages. The term "Cellular Rubber" has supplanted that of "Sponge Rubber" which was used in previous editions. As usual, excellent cross-referenced author and subject indexes make the location of any particular subject or product an easy matter.

•

How to Evaluate Supervisory Jobs. By Albert N. Gillett. Published by the National Foremen's Institute, Inc., Deep River, Conn. 8½ x 11 in. 141 pp. (looseleaf). $7.50.

Directed toward an important current problem, this manual provides detailed answers to two key questions: (1) What is the supervisory job worth? (2) How good is the man occupying that position? It is divided into three sections. Part I explains and describes the Job-Analysis-Rating-Evaluation of Supervision method, which enables management to determine how much the job itself is worth in either hourly rate or salary range. Part II is devoted to a detailed description of a definite plan by which management can determine the weak and strong points of the individual occupying the supervisory position. Part III supplies the reader with a working kit of blank forms for running his own tests, the forms being designed for actual use and being applicable to both plant and office personnel.

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BOOKLETS, CATALOGS, etc.

Report on Malayan and British Borneo Rubber Industry. Prepared by E. G. Holt. Available from Superintendent of Documents, Washington 25, D. C. 8 x 10 in. 72 pp. 25c.

Report on Netherland Indies Rubber Industry. Prepared by E. G. Holt. Available from Superintendent of Documents, Washington 25, D. C. 8 x 10 in. 64 pp. 20c.

Report on Indochina Rubber Industry. Prepared by E. G. Holt. Available from Superintendent of Documents, Washington 25, D. C. 8 x 10 in. 24 pp. 15c.

Conditions in the rubber-producing countries in the Far East are summarized in these three reports issued by the Department of Commerce. The reports, which survey the rubber industry in Malaya, British Borneo, Netherlands East Indies, Indochina and Siam (the latter covered in the report on Indochina), were prepared by Mr. Holt, rubber advisor of the Department, as a result of an extensive investigation made on behalf of the Department and the Rubber Development Corporation. During the investigation, Mr. Holt visited the trading centers and accessible producing areas of the Far East in a three-months tour last summer. The reports contain a review of rubber production rates during 1946 and discuss prospective production for the future. Other phases of the rubber producing industry covered include general economy of the countries, political background, currency considerations, estate and native acreage, remilling, equipment, labor, supplies, transportation, production under the Japanese, reoccupation steps, progress in recovery, and rubber stocks. The reports reflect Mr. Holt's usual painstaking efforts.

•

Insulating Varnishes. General Electric Co., Pittsfield, Mass., 8½ x 11 in. 48 pp.

Designed as a reference manual, this booklet contains complete technical data on the insulating varnishes manufactured by the company. The varnishes have been grouped according to their uses and characteristics, making them convenient for quick appraisal and information. The varnishes are grouped as follows: black baking, black air drying, clear baking, clear air drying, black baking and air drying, clear baking and air drying, sticking varnishes, and air drying and baking enamels. Specifications, electrical properties, film properties, cure and aging, chemical properties, and baking and air drying cycles of each are given.

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REVIEWS (CONT'D)

Summary of Technical and Patent Assets: 1946 Edition. Phillips Petroleum Co., Bartlesville, Oklahoma. 8¾ x 11¼ in. 216 pp.

This book contains references to patent and technical data covering various activities, processes, and products of the company. Divided into eleven parts, it includes sections on synthetic rubber, carbon black, chemicals, lubricants, catalysts, and catalyst regeneration. These sections are subdivided in the body of the book and a brief discussion is presented for each section and subsection. Abstracts of the issued patents relating to each of these sections have been included for the purpose of giving the reader a general idea of the value, but not of the scope, of the field covered by each patent. In many sections photographs of commercial units and equipment are shown. Simplified flow diagrams and descriptions of some specific processes which have reached the commercial or semi-commercial stage are also included.

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Institut Francais du Caoutchouc et Corollaires Coloniaux. (French Rubber Institute and Colonial Corollaries). Issued by the Institute, 42 Rue Scheffer, Paris, France. 8½ x 10½ in. 32 pp. (In French).

The origin and purpose of the French Rubber Institute, and later of two of its colonial affiliates, is detailed in this informative boklet. The booklet includes a table of organization of the Institute, lists the men heading the various sections, and outlines the specific function of each section. A brief, illustrated description of the laboratory is included. Similar information on the two colonial affiliates—Institut de Recherches sur le Caoutchoud en Indochine (I.R.C.I.) and Institut de Recherches sur le Caoutchouc en Afrique (I.R.C.A.)—also appears in the booklet.

•

Du Pont Color Conditioning for Industry. Finishes Division, E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 8¼ x 11¼ in. 32 pp.

Illustrating and describing years of research and practical experience with color to increase production, improve seeing conditions and create a better working environment, this booklet makes clear the fundamental principles on which color conditioning is based. The "Three-Dimensional Seeing" treatment of machines is depicted with photographs of actual installations, and color conditioning is shown at work in plants of several well-known companies. The Safety Color Code for Industry is also outlined. A coordinated functional color program for an entire plant is illustrated in a double-page cutaway drawing.

•

Koroseal Handbook of Technical Information. B. F. Goodrich Co., Akron, Ohio. 8⅜ x 10¾ in. 24 pp.

As the first in a series of booklets dedicated by the company to technical service, this booklet serves as a general introduction to Koroseal, the company's plasticized vinyl resin. The physical, chemical, electrical, and processing characteristics of Koroseal compounds are given, and several applications of the material are suggested. Data is presented on the effect of quantity of plasticizer on the material, as well as the electrical effect of aging differences in plasticizers and physical effects of various pigments. A manufacturing flow diagram and a table of physical constants are also included.

•

Treet-O-Control. (Bulletin No. 1200). % Proportioneers, Inc., %, 9 Codding St., Providence 1, R. I. 8½ x 11 in. 28 pp.

Intended as a handy reference, this catalog deals with automatic flow responsive equipment and methods in continuous process operation for most treating, blending, sampling, and diluting processes. Photographs of chemical proportioning equipment and typical installations are supplemented by many flow diagrams and detailed drawings. The company's method is clearly explained and the operation of the equipment is demonstrated by two-color diagrams.

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MARKETS

Rubber – Crude, Reclaimed and Scrap – Cotton – Ducks – Tire Fabrics – Sheetings

NEW YORK, MARCH 6, 1947

Natural Rubber

THE question whether the importation of natural rubber into the United States will be continued under the present public purchase program or will be opened to private trade by March 31 will be settled by legislation within the next few weeks. As reported elsewhere in the news section of this issue, and commented on editorially, Congressional sentiment, particularly in the House, favors immediate restoration of free trade, with controls maintained over allocation. The Senate, however, could easily upset this situation. Importing circles are, of course, strong for immediate reopening of free trade.

An interesting report on the status of rubber cultivation in the Netherlands Indies was made in recent weeks by the Netherlands Information Bureau. The report indicated that although the full effects of the Japanese occupation in the Indies cannot yet be evaluated because of the impossibility of investigating conditions on Java and Sumatra, it is believed that altogether some 150,000 acres of western-owned rubber plantations have been destroyed. This is about 10% of the total plantation area. The total area of individually-owned rubber farms, however, is believed to have undergone no change. The data is based on Japanese reports.

Rubber traders are keenly watching developments in connection with the United States liberty ship *Martin Behrman*. This ship was loaded with rubber, cinchona, and other materials at Cheribon, a port east of Batavia and under control of Indonesian Republicans. On March 4 the Dutch Government ordered the ship seized on the ground that the cargo was produced on European-owned plantations and was not the property of the Indonesians. The skipper of the ship, charted by the Isbrandsten Shipping Co., has ordered his crew to resist seizure. Final decision in this instance may set the pattern for future shipments.

Prices shown below are those established by Rubber Reserve on January 3:

Plantations—

Ribbed Smoked Sheets, No. 1X	.25¾
Thick Pale Latex Crepe, No. 1X	.25¾
Thin Pale Latex Crepe, No. 1X	.25¾
Thick Brown Crepe, No. 1X	.24½
Thin Brown Crepe, No. 1X	.24½
Thick Remilled Blankets, No. 1	.24½
Thin Brown Remilled Crepe, No. 1	.24½
Rolled Brown or Flat Bark	.21¼
Smoked Blankets, No. 1	.24½
Claro Brand 1XRSS	.25¾
Sole Crepe Trimmings	.25¼
R.C.M.A. Wtmkd. Crepe, No. 16	.29½
Sole Crepe	.25¾

Wild—

Uncut Fines, Crude	.18¼
Cut Fines, Crude	.18¾
Cut Fines, Washed & Dried	.25¾
Islands Fine, Crude	.17⅞
Weak Fine, Crude	.17⅜
Cameta, Crude	.13
Upriver Coarse, Crude	.15⅞
Manicoba, Crude	.15½
Caucho Ball, Crude	.14⅞
Panama Slab, Crude	.12⅞
Mangabiera, Crude	.11¾
Cameroons, Crude	.19½

Guayule—

Carload Lots	.20¾
Less-than-Carload Lots	.21¼

Latex—

Normal, Tank Car Lots	.29¼
Normal, Carload Drums	.31½
Normal, Less than 1 Drum	.38½
Centrifuged, Tank Car Lots	.31
Centrifuged, Carload Drums	.32½
Centrifuged, Less than 1 Drum	.39¾

Scrap Rubber

The gloomy condition evident in the scrap rubber field in the past few months has continued in recent weeks, with the export market remaining the one bright spot. How important the export market has become to the field was revealed in figures released on February 25 by the Office of International Trade of the Department of Commerce. United States exports of scrap rubber in 1946 amounted to 75,997,689 pounds, which is almost equal to the 1937 shipments of 76,649,767 pounds, and is greater than the 60,084,455 pounds shipped in 1938. China and Hongkong, receiving 29,517,510 pounds and 13,428,773 pounds, respectively, were the principal recipients of the 1946 shipments. Current quotations on various grades of scrap rubber follow:

(Prices to Consumers, Delivered Akron)

Mixed passenger tires	ton	$19.00
Beadless truck tires	ton	25.00
Mixed truck tires	ton	19.00
Beadless passenger tires	ton	25.00
No. 1 passenger peelings	ton	50.00
No. 1 truck peelings	ton	50.00
No. 2 passenger tubes	lb.	.07½
Red passenger tubes	lb.	.07½
Black passenger tubes	lb.	.06½
Mixed passenger tubes	lb.	.06½
No. 2 truck tubes	lb.	.07¼
Red truck tubes	lb.	.07
Black truck tubes	lb.	.07
Buffings	ton	18.00
Air bags and water bags	ton	——
Boots and shoes	ton	——

Cotton Tire Fabrics

Producers of cotton tire fabrics are still fairly hard put to keep up with customer requirements, but the slight slackening in over-all demand, reported last month, was still evident in recent weeks. Producers are still confident that they will be able to meet all demands for the current year. The demand for both fabrics and chafers for the export market is still strong and whereas orders have been accepted in recent months "for early delivery" a few actual deliveries are now beginning to be made. This is another indication of the slackening in demand on the part of the domestic market. No changes in the price structure have been reported since our last issue. Current quotations on typical grades follow:

Standard, Peeler, 12/4/2	lb.	.7405
Standard, Peeler, 14/4/2	lb.	.7542
Standard, Peeler, 16/4/3	lb.	.7680
Extra Staple, Peeler, 12/4/2	lb.	.8370
Extra Staple, Peeler, 14/4/2	lb.	.8508
Extra Staple, Peeler, 16/4/3	lb.	.8646

Chafers

14.4 oz (per sq. yard)	lb.	.7159
9.25 oz. (per sq. yard)	lb.	.7445
11.65 oz (per sq. yard)	lb.	.6444
8.9 oz. (per sq. yard)	lb.	.6873

Sheetings

48x40	36 in.	5.50	yd.	—	@13.276
40x40	36 in.	6.15	yd.	—	@11.890
40x36	36 in.	6.50	yd.	—	@10.723
48x48	40 in.	2.50	yd.	—	@27.594
48x48	40 in.	2.85	yd.	—	@23.075
56x60	40 in.	3.60	yd.	—	@19.229
48x44	40 in.	3.75	yd.	—	@18.830

Cotton

The price of middling uplands on the Cotton Exchange has swung in the wide range of 194 points since our last report (February 6), high for the period being 35.53 on March 6 and low 33.59 on February 6. The average price for middling uplands for the month of February was 33.91, based on 22 trading days. In spite of the fact that the Department of Agriculture announced a cut in the export subsidy rate on the United States staple from four to two cents per pound on February 13, the upward trend in prices, which was started in the latter half of January, continued throughout the period. The outstanding developments contributing to the optimism in the cotton market were as follows: (1) The official report on consumption of all cottons in this country during January, which indicated that 947,000 bales of cotton had been consumed, as compared with 774,000 in December, and 811,000 in January a year ago; (2) The report issued by the Department of Agriculture which placed mid-February cotton parity price at 27.40 cents per pound, an increase of 74 points from the mid-January level of 26.66, and which compares with the 1945 mid-February price of 22.20. Quotations for middling uplands on the Exchange follow:

	Feb. 6	March 6		
	Close	High	Low	Close
May	31.62	34.37	33.97	34.15
July	29.60	32.42	31.98	32.23
October	26.95	29.90	29.45	29.62

Reclaimed Rubber

Demand for reclaimed rubber still continues at a pace satisfactory to the reclaimers although another slight drop in consumption was noted in December, 1946. According to figures of the Rubber Manufacturers Association, consumption in December amounted to 23,684 long tons, a drop of 2.88% from the 24,385 (revised) tons consumed in November, which, in turn, was a drop of approximately 8% from that in October. Consumption for the year of 1946, according to the R. M. A., amounted to 275,497 tons, an increase of 14.3% over the 241,036 consumed in the previous year. Production of reclaim in 1946 amounted to 295,655 long tons, according to the Rubber Reclaimers Association, which compares with 243,309 tons produced in 1945, a 20% gain. Current quotations on various grades of reclaim follow:

Tires

Black (acid process)	lb.	.08½	@	.08¾
Black, selected tires	lb.	.07½	@	.07¾
Truck, Heavy Gravity	lb.	.09½	@	.09¾

Shoe

Unwashed	lb.	.08	@	.08¼

Tube

Black Tube	lb.	.12¼	@	.12½
Red Tube	lb.	.13	@	.13¼

Miscellaneous

Mechanical blends	lb.	.05½	@	.06½
White	lb.	.14	@	.14¼

Ducks

Enameling (single filling)	lb.	—	@	69.750
Belting and Hose	lb.	—	@	67.166
Single filling, A grade	lb.	—	@	63.000
Double filling, A grade	lb.	—	@	67.000

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STATISTICS *Of Interest to the Rubber Industry*

U. S. Imports and Re-Exports of Natural Rubber

	GROSS IMPORTS											
	Natural Rubber (Dry)			Natural Rubber (Latex)			Guayule				RE-EXPORTS		TOTAL NET IMPORTS
Year	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Long Tons	Total Declared Value	Average Declared Value per pound Cents	Total Gross Imports Long Tons	Long Tons	Total Declared Value	Long Tons
1936	467,064	152,072,496	14.54	19,852	6,659,809	14.98	1,229	286,552	10.41	488,145	12,581	4,488,223	475,564
1937	574,600	237,307,041	18.44	23,185	10,213,670	19.67	2,694	745,873	12.36	600,479	7,902	3,385,433	592,577
1938	397,620	125,357,730	14.07	11,878	4,147,318	15.59	2,485	623,819	11.21	411,983	5,652	1,799,124	406,331
1939	469,803	167,558,245	15.92	27,438	10,467,552	17.03	2,232	463,345	9.27	499,473	13,125	5,832,618	486,348
1940	780,820	303,117,726	17.33	33,789	14,593,466	19.28	3,634	758,007	9.31	818,243	7,060	3,197,136	811,183
1941	989,329	401,890,393	18.14	34,798	15,965,627	20.48	4,881	1,145,767	10.48	1,029,008	5,376	2,757,872	1,023,632
1942	265,980	112,377,896	18.86	10,646	5,630,667	23.61	5,523	1,660,792	13.42	282,149	10,856	5,913,386	271,293
1943	90,348	31,364,033	27.81	1,890	1,312,202	30.99	7,679	3,636,789	21.14	59,917	22,587	16,446,707	37,330
1944	103,820	73,908,389	31.78	3,091	2,092,211	30.22	6,700	3,351,233	22.33	113,611	9,739	8,712,695	103,872
1945	134,454	95,850,441	31.82	4,773	3,115,853	29.14	10,040	5,963,797	26.52	149,267	9,509	7,201,746	139,758
1945:													
Jan.	15,626	11,125,799	31.71	206	134,890	29.18	880	476,377	24.17	16,712	1,316	1,024,712	15,396
Feb.	16,592	11,915,425	32.06	402	262,604	29.15	1,843	1,053,328	25.51	18,837	729	625,824	18,108
Mar.	10,254	7,297,267	31.77	434	283,209	29.13	652	384,518	26.33	11,340	1,979	1,420,759	9,361
Apr.	9,743	6,813,597	31.23	253	164,965	29.15	807	486,473	26.91	10,803	1,560	1,148,184	9,243
May	10,375	7,560,578	32.53	235	153,481	29.15	865	525,953	27.14	11,475	208	145,880	11,267
June	7,991	5,467,478	30.54	692	451,629	29.15	675	412,213	27.26	9,358	456	347,623	8,902
July	9,568	6,973,890	32.54	336	219,469	29.15	605	371,245	27.39	10,509	620	455,658	9,889
Aug.	9,741	6,880,325	31.53	624	407,677	29.15	841	506,655	26.91	11,206	894	824,976	10,312
Sept.	9,870	7,050,795	31.89	626	408,651	29.15	668	409,535	27.38	11,164	406	310,128	10,758
Oct.	10,673	7,645,618	31.98	287	187,422	29.15	646	391,971	27.07	11,606	562	369,296	11,044
Nov.	11,177	7,844,162	31.33	296	193,252	29.15	739	446,925	27.65	12,212	254	179,321	11,958
Dec.	12,844	9,273,507	32.24	382	248,604	29.15	819	498,604	27.20	14,045	525	349,385	13,520
1946:													
Jan.	18,580	13,515,971	32.48	569	371,857	29.15	446	263,279	26.33	19,595	164	41,992	19,431
Feb.	32,690	26,944,266	32.70	...	.....	....	318	171,823	24.10	33,008	723	444,400	32,285
Mar.	31,093	22,520,391	32.33	504	328,905	29.15	160	87,344	24.34	31,757	714	488,044	31,043
Apr.	26,234	18,997,757	32.33	1,001	808,463	36.06	874	467,151	23.86	28,109	392	243,952	27,717
May	4,784	3,314,818	30.93	1,052	687,100	29.11	430	219,830	22.82	6,266	422	419,278	5,844
June	8,518	6,132,895	32.15	561	366,165	29.15	466	244,580	23.41	9,545	460	446,253	9,085
July	20,641	13,947,817	30.17	696	451,523	28.96	291	148,442	22.85	21,628	2,457	1,600,600	19,171
Aug.	34,125	18,656,966	24.41	1,231	803,435	29.14	366	193,680	23.06	35,722	1,515	902,005	34,207
Sept.	41,311	22,317,275	24.12	...	.....	....	425	219,849	23.09	.....	143	81,581	.....
Oct.	45,523	24,745,403	24.27	672	438,938	29.15	691	377,319	24.38	46,886	649	613,424	46,237
Nov.	58,756	30,648,620	23.29	130	85,363	29.24	379	200,270	23.58	59,265	60	29,800	59,205
Dec.*	44,159	23,810,760	23.87	2,005	1,501,336	33.43	494	265,679	24.02	46,658	17	20,625	46,641

Source: U. S. Department of Commerce.
Notes: (1) Figures for latex are on a dry weight basis. (2) Figures for re-exports include natural rubber (dry and latex) and guayule. * Estimated.

Natural Rubber
(Including Latex and Guayule)
(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1936	488,145	575,000	12,581	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946*	405,070	285,350	4,506	238,863
1945:				
Mar.	9,146	10,983	1,797	103,319
Apr.	10,046	9,793	867	102,705
May	10,067	10,164	130	102,478
June	9,940	8,995	204	103,219
July	8,739	7,698	756	103,504
Aug.	10,259	7,392	777	105,594
Sept.	12,150	5,799	560	111,385
Oct.	13,984	7,206	78	118,085
Nov.	7,288	7,575	255	117,543
Dec.	7,884	8,185	92	118,715
1946:				
Jan.	25,143	10,355	209	133,294
Feb.	35,104	10,131	290	157,977
Mar.	35,348	12,792	445	180,088
Apr.	19,847	16,914	190	182,831
May	6,126	17,867	327	170,763
June	23,382	16,466	911	176,768
July	14,942	21,998	222	169,490
Aug.	45,087	28,405	592	185,580
Sept.	46,122	31,132	988	199,591
Oct.	36,735	35,421	106	200,799
Nov.	55,231	37,323	35	218,672
Dec.*	57,620	38,767	23	237,502
1947:				
Jan.*†	102,080	45,372	28	294,147

Source: 1936-40, U. S. Department of Commerce; 1941 to date, Civilian Production Administration. * Estimated. † Excluding Guayule.

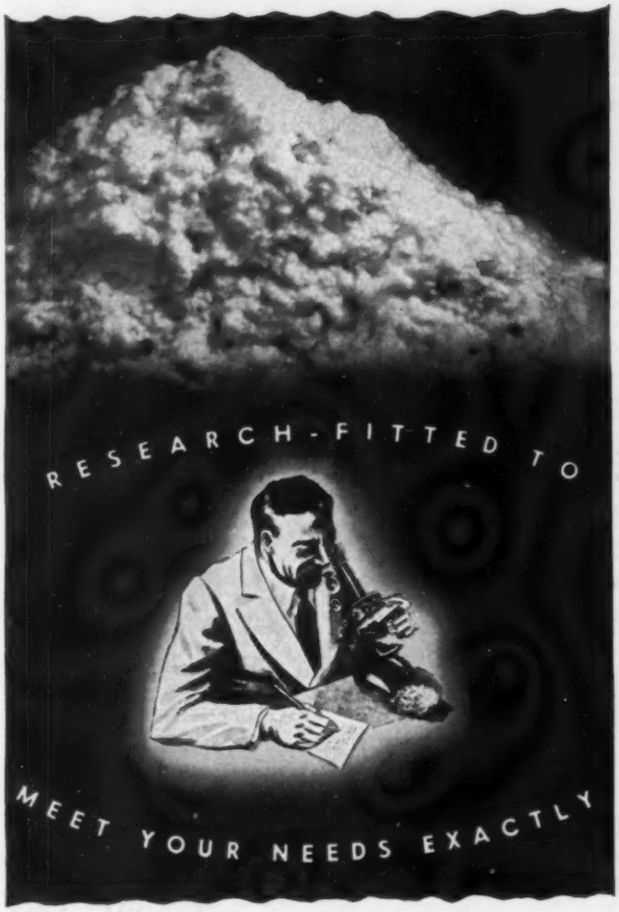
U.S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

	Balata		Jelutong		Gutta-Percha & Other Guttas	
Year	Tons	Value	Tons	Value	Tons	Value
1936	535	199,368	6,163	1,296,364	1,568	555,643
1937	354	151,344	7,109	2,017,786	1,122	440,894
1938	509	181,140	9,132	2,944,504	444	204,582
1939	694	265,553	6,640	1,603,418	1,740	539,255
1940	648	300,500	7,451	2,449,137	2,340	1,004,885
1941	924	489,514	8,821	2,954,001	1,783	607,025
1942	1,544	1,107,059	1,200	530,296	804	525,763
1943	1,047	708,701	35	14,840	....	.....
1944	1,012	660,805	88	45,578	10	4,999
1945	1,361	907,253	....	.....	36	21,970
1945:						
Jan.	121	74,964	....	.....	....	.....
Feb.	24	17,441	....	.....	....	.....
Mar.	150	69,291	....	.....	....	.....
Apr.	36	18,486	....	.....	....	.....
May	110	60,465	....	.....	3	3,244
June	8	6,872	....	.....	....	.....
July	228	128,129	....	.....	....	.....
Aug.	154	80,296	....	.....	....	.....
Sept.	49	52,148	....	.....	5	2,196
Oct.	130	83,173	....	.....	....	.....
Nov.	303	257,246	....	.....	10	6,547
Dec.	48	58,742	....	.....	18	9,983
1946:						
Jan.	129	121,228	....	.....	....	.....
Feb.	38	35,699	....	.....	5	2,178
Mar.	100	70,315	....	.....	....	.....
Apr.	362	261,098	....	.....	....	.....
May	325	212,899	....	.....	....	.....
June	80	80,006	....	.....	....	.....
July	219	178,564	115	91,412	7	19,839
Aug.	234	249,380	....	.....	4	13,438
Sept.	159	161,937	4	9,337	23	47,147
Oct.	282	367,393	21	29,307	305	216,901
Nov.	152	270,379	28	39,502	3	10,233
Dec.*	199	287,167	57	41,757	26	52,096

Source: U. S. Department of Commerce. * Estimated.

Rayco Flock



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Synthetic Rubber

(GR-S, Neoprene, Butyl, and Buna N Types)

(All Quantities in Long Tons)

Year	Production	Imports	Consumption	Exports	Stocks On Hand at End of Period
1941	8,383	.....	6,259	672	1,699
1942	22,434	.....	17,651	1,419	4,608
1943	231,722	.....	170,891	18,148	47,295
1944	762,630	11,043	566,670	104,266	150,032
1945	820,373	10,407	693,580	83,778	203,454
1946†	740,026	7,709	756,315	72,920	116,570
1945:					
Mar.	77,298	417	63,846	4,664	169,704
Apr.	75,846	751	59,437	6,688	180,487
May	83,309	1,418	62,837	7,435	193,663
June	78,702	1,270	58,627	7,363	203,018
July	78,650	1,428	52,571	12,085	218,369
Aug.	69,703	1,491	54,439	10,856	224,117
Sept.	63,754	928	45,479	3,801	239,683
Oct.	47,317	237	58,667	1,596	226,550
Nov.	48,634	471	56,227	7,984	214,289
Dec.	46,593	473	56,112	5,341	203,454
1946:					
Jan.	56,089	.....	66,993	5,715	177,051
Feb.	51,848	.....	63,770	6,415	144,427
Mar.	60,363	1,429	74,214	17,707	115,310
Apr.	66,014	536	70,703*	12,878*	101,510*
May	66,044	366	70,914	13,102	93,447
June	63,388	415	62,899	5,161*	94,095*
July	63,176	353	54,562	3,175	101,007
Aug.	64,300	634	61,486	2,175	103,076
Sept.	63,765*	1,031	58,798*	2,480	108,840*
Oct.	62,086	1,149	60,729	474	110,913
Nov.	60,315	894	57,794	1,781	113,874
Dec.†	62,647	902	53,766	1,846	121,651
1947:					
Jan.†	62,104	0	57,367	3,360	117,947

Source: Civilian Production Administration.
Note: Production figures include the output of privately-owned and government plants. Figures for 1941 are estimated. * Revised. † Preliminary.

Synthetic Rubber—By Type

(All Quantities in Long Tons)

New Supply

	GR-S (Buna S)	GR-M (Neoprene)[b]	GR-I (Butyl)	Buna N Types[b]	Total
1942	3,721	8,956	.....	9,734	22,411
1943	182,259	33,603	1,373	14,487	231,722
1944	679,949	56,660	20,252	16,812	773,673
1945	724,859	45,672	52,378*	7,871	830,780
1946*	613,408	47,765	80,823	5,738	747,734

Consumption

1942	2,529	6,833	.....	8,217	17,629
1943	131,977	26,205	304	12,405	170,891
1944	495,552	46,243	10,763	14,112	566,670
1945[a]	676,700	42,394	43,012	8,029	770,135
1946*	632,126	44,357	79,228	5,988	761,699

Exports

1942	222	1,037	.....	160	1,419
1943	14,937	2,540	40	631	18,148
1944	98,380	4,799	530	557	104,266
1945	76,555	5,837	980	406	83,778
1946*	68,763	2,631	495	1,020	72,909

Stocks at End of Period

1942	1,050	1,786	4	1,772	4,608
1943	36,395	6,644	1,033	3,223	47,295
1944	122,412	12,262	9,992	5,366	150,032
1945	170,571	9,703	18,378	4,802	203,454
1946*	83,090	10,470	19,478	3,532	116,570

Sources: From miscellaneous Government reports.
Notes: (a) Consumption figures for 1945 include exports. (b) Including production of privately-owned plants. (*) Estimated. Revisions of figures in this table are made from time to time and the latest issue should be consulted for accuracy.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1939	1940	1941	1942	1943	1944	1945	1946
Jan.	38,089	40,370	46,190	49,216	36,085	47,540	51,125	51,186
Feb.	34,928	37,557	42,782	42,666	36,274	47,754	49,013	47,889
Mar.	43,042	44,607	49,572	50,820	41,586	52,263	55,449	56,801
Apr.	44,264	47,683	55,879	49,554	48,177	50,005	59,147	62,045
May	49,766	52,946	60,121	53,212	49,828	54,230	60,828	66,774
June	50,133	55,459	59,062	50,077	52,325	54,266	60,597	63,221
July	50,689	53,865	63,906	54,606	49,867	55,119	66,218	69,044
Aug.	54,025	55,346	63,575	48,793	51,880	55,616	70,027	66,701
Sept.	49,505	52,297	59,768	50,093	49,707	56,318	64,550	62,216
Oct.	49,854	53,807	58,412	50,094	53,111	53,154	55,743	66,598
Nov.	47,407	49,074	54,670	50,729	50,703	54,967	53,581	61,315
Dec.	43,807	46,413	53,568	39,250	48,695	52,250	50,129	.....
Total	555,509	589,424	667,505	589,110	568,238	633,482	696,407	.....

Source: U. S. Bureau of Mines.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	Production	Consumption—Tons	Consumption—% to Crude[a]	Exports	Stocks On Hand at End of Period
1936	150,571	141,486	24.6	7,085	19,000
1937	185,033	162,000	29.8	13,233	28,800
1938	122,400	120,800	27.6	7,403	23,000
1939	186,000	170,000	28.7	12,611	25,250
1940	208,971	190,244	29.3	11,347	32,636
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007	254,820	64.6	30,405	42,532
1943	304,058	291,082	59.6	15,678	46,201
1944	260,631	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946[b]	295,612	275,410	26.5	14,161	33,666
1945:					
Mar.	22,042	22,891	30.6	1,409	37,186
Apr.	20,389	20,234	29.2	1,125	36,216
May	22,249	22,459	30.8	971	35,035
June	20,187	19,873	29.4	996	34,353
July	17,033	15,976	26.5	836	34,374
Aug.	18,804	18,663	30.2	834	33,881
Sept.	17,246	17,365	33.9	1,323	32,439
Oct.	22,044	22,185	33.7	1,195	31,103
Nov.	20,560	20,263	31.8	859	30,541
Dec.	20,632	19,590	30.5	1,391	28,155
1946:					
Jan.	24,458	22,031	28.5	1,253	29,099
Feb.	23,187	20,702	28.0	1,368	30,216
Mar.	25,136	22,075	26.0	1,841	31,436
Apr.	23,930*	22,396*	25.8	1,238	31,732*
May	25,322	22,162	24.9	1,338	33,554
June	24,882*	21,725*	27.4	1,416	35,295
July	22,619	21,350	27.9	961	35,603
Aug.	25,798	24,566	27.3	1,093	35,742
Sept.	23,956	23,715	26.4	579	35,404
Oct.	26,322	26,706	27.7	759	34,261
Nov.	24,748	24,385	25.6	1,108	33,516
Dec.[b]	25,254	23,597	25.6	1,507	33,666
1947:					
Jan.[b]	25,584	26,061	25.4	1,443	31,746

Source: 1936-40, Department of Commerce; 1941 to date, Civilian Production Administration. * Revised. (a) Includes natural and synthetic rubber. (b) Preliminary.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1930	2,784,745	571,241	3,355,986	1938	2,000,985	485,852	2,486,837
1931	1,973,090	416,648	2,389,738	1939	2,866,796	704,308	3,571,104
1932	1,135,491	235,187	1,370,678	1940	3,692,328	721,637	4,413,965
1933	1,573,512	346,545	1,920,057	1941	3,744,300	875,381	4,619,681
1934	2,177,919	575,192	2,753,111	1942	220,814	133,083	353,897
1935	3,252,244	694,690	3,946,934	1943	0	4,501	4,501
1936	3,669,528	781,862	4,451,390	1944	0	124,819	124,819
1937	3,915,889	892,382	4,808,271	1945	83,792	313,643	397,435
				1946	2,148,677	930,739	3,079,416
1946							
Jan.	56,367	45,033	101,400	July	209,180	87,454	296,634
Feb.	57,784	34,914	92,698	Aug.	247,261	97,881	345,142
Mar.	85,810	37,636	123,446	Sept.	232,280	95,658	327,938
Apr.	132,631	80,762	213,393	Oct.	283,586	107,154	390,740
May	166,942	75,373	242,315	Nov.	269,081	100,892	369,973
June	141,090	60,038	201,128	Dec.	266,665	107,616	374,281
1947							
Jan.	247,130	101,092	348,222	July	.....	.....	.....
Feb.	.....	.....	.....	Aug.	.....	.....	.....
Mar.	.....	.....	.....	Sept.	.....	.....	.....
Apr.	.....	.....	.....	Oct.	.....	.....	.....
May	.....	.....	.....	Nov.	.....	.....	.....
June	.....	.....	.....	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Rim Production

	1941	1942	1943	1944	1945	1946
Passenger Car	17,828,994	1,025,880	780,291	1,748,917	4,504,368	15,058,469
Truck & Bus	6,464,725	5,298,603	4,949,004	6,391,441	6,486,652	5,939,244
Agricultural	1,576,720	194,900	301,997	997,301	1,441,909	1,735,992
Earth Mover	2,593	1,814	945	703	1,308	5,520
Total	25,873,032	6,521,197	6,032,237	9,138,362	12,434,237	22,739,225

	1946					1947
	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.
Passenger Car	1,489,104	1,686,541	1,544,017	1,675,066	1,621,532	1,547,429
Truck & Bus	555,870	798,803	756,984	658,268	783,872	714,896
Agricultural	140,558	207,928	154,086	169,465	205,260	226,614
Earch Mover	103	2.848	197	334	237	185
Total	2,185,635	2,696,120	2,455,284	2,503,133	2,610,901	2,489,124

Source: The Tire & Rim Association, Inc.

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(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1935 (total)	19,263	29,406	1,514	50,183	49,362	8,196
Passenger Car	17,063	26,036	948	44,047	43,256	7,054
Truck and Bus	2,200	3,370	566	6,136	6,106	1,142
1936 (total)	21,446	30,866	1,073	53,385	56,041	10,717
Passenger Car	18,941	26,999	644	46,584	49,013	9,291
Truck and Bus	2,505	3,867	429	6,801	7,028	1,426
1937 (total)	22,353	29,886	1,246	53,485	53,310	10,383
Passenger Car	20,055	26,177	696	46,928	46,497	8,745
Truck and Bus	2,298	3,709	550	6,557	6,813	1,638
1938 (total)	11,516	30,567	1,049	43,132	40,907	8,451
Passenger Car	10,086	27,104	580	37,770	35,789	6,937
Truck and Bus	1,430	3,463	469	5,362	5,118	1,514
1939 (total)	18,208	38,022	1,279	57,509	57,613	8,665
Passenger Car	15,742	33,471	607	49,820	49,933	7,108
Truck and Bus	2,466	4,551	672	7,689	7,680	1,557
1940 (total)	22,252	35,346	1,176	58,774	59,186	9,127
Passenger Car	19,560	30,903	411	50,874	50,965	7,270
Truck and Bus	2,692	4,443	765	7,900	8,221	1,857
1941 (total)	24,780	39,895	1,489	66,164	61,540	4,436
Passenger Car	19,855	34,119	586	54,560	50,392	3,165
Truck and Bus	4,925	5,776	903	11,604	11,148	1,271
1942 (total)	6,680*	8,872*	207*	15,759*	15,351*	6,247*
Passenger Car	910*	2,734*	38*	3,682*	2,790*	4,432*
Truck and Bus	5,770*	6,138*	169*	12,077*	12,561*	1,815*
1943 (total)	6,128	18,547	225	24,900	20,423	1,883
Passenger Car	82	10,606	71	10,759	7,620	1,132
Truck and Bus	6,046	7,941	154	14,141	12,803	751
1944 (total)	6,654	26,439	[illegible]	33,356	33,446	2,013
Passenger Car	208	18,330	130	18,668	18,819	1,218
Truck and Bus	6,446	8,109	133	14,688	14,627	795
1945 (total)	5,984	36,479	504	42,967	44,524	3,077
Passenger Car	1,115	25,463	222	26,800	28,200	2,214
Truck and Bus	4,869	11,016	282	16,167	16,324	863
1946 (total)	15,289	65,055	1,516	81,860	82,014	2,457
Passenger Car	11,082	54,339	664	66,084	66,259	1,769
Truck and Bus	4,207	10,716	852	15,776	15,755	688
1946:						
September (total)	1,636	5,208	98	6,943	7,233	3,370
Passenger Car	1,188	4,398	40	5,626	5,869	2,586
Truck and Bus	448	810	58	1,317	1,364	784
October (total)	1,874	6,445	114	8,433	8,205	3,041
Passenger Car	1,394	5,474	49	6,917	6,667	2,265
Truck and Bus	480	971	65	1,516	1,538	776
November (total)	1,656	5,662	168	7,486	7,579	3,026
Passenger Car	1,229	4,805	76	6,110	6,170	2,208
Truck and Bus	427	857	92	1,376	1,409	818
December (total)	1,839	6,086	221	8,146	7,518	2,458
Passenger Car	1,383	5,114	109	6,607	6,101	1,770
Truck and Bus	456	972	112	1,539	1,417	688

Source: The Rubber Manufacturers Association, Inc. * Revised.

Cotton, Rayon and Nylon Tire Fabrics

(Production in Thousands of Pounds)

	Cotton				Rayon and Nylon [b]		
	Tire Cord Not Woven	Cord Fabric Woven	Chafer and All Other Tire Fabrics	Total	Tire Cord Not Woven	Tire Cord And Other Tire Fabrics	Total
1943:							
Jan.-Mar.	11,155	34,287	7,819	53,261	564	9,833	10,397
Apr.-June	11,625	34,684	8,549	54,858	1,253	10,185	11,438
July-Sept.	15,754	36,854	9,618	62,226	1,220	9,184	10,404
Oct.-Dec.	15,928	42,639	10,464	69,031	1,806	12,055	13,861
Total	54,462	148,464	36,450	239,376	4,843	41,257	46,100
1944:							
Jan.-Mar.	17,135	42,783	11,452	71,370	1,812	15,830	17,642
Apr.-June	17,587	40,580	11,499	69,666	1,353	19,586	20,939
July-Sept.	16,653	38,462	11,055	66,170	1,299	25,915	27,214
Oct.-Dec.	12,982	34,107	10,948	58,037	2,773	33,630	36,403
Total	64,357	155,932	44,954	265,243	7,237	94,961	102,198
1945:							
Jan.-Mar.	16,674	43,835	12,306	72,812	3,726	37,777	41,503
Apr.-June	16,044	42,383	13,604	72,031	4,064	42,476	46,540
July-Sept.	15,136	38,158	14,122	67,416	3,549	42,606	46,155
Oct.-Dec.	15,514	36,442	13,573	65,529	a	47,734	47,734
Total	63,365	160,818	53,605	277,788	11,339	170,593	181,932
1946:							
Jan.-Mar.	17,128*	39,377*	15,245*	71,750*	a	51,208*	51,208*
Apr.-June	19,622	40,197	18,623	78,442	a	52,511	52,511
July-Sept.	17,279	39,261	19,684	76,224	5,102	46,915	52,017

Source: U. S. Bureau of the Census.
Notes: (a) Included with tire cord and fabrics to avoid disclosures of operations of individual mills. (b) Fuel cell fabrics are not included with rayon and nylon tire cord and fabrics. * Revised.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1935	19,218	28,095	754	48,067	47,879	8,231
1936	21,514	32,188	721	54,423	57,036	10,945
1937	22,464	29,554	749	52,767	52,373	10,312
1938	11,515	28,134	644	40,293	37,848	8,166
1939	18,190	31,998	1,002	51,190	50,649	7,036
1940	22,172	29,070	972	52,214	52,237	7,017
1941	24,722	33,749	1,232	59,703	57,433	4,686
1942	n.a.	n.a.	n.a.	13,958	12,568	5,742
1943	6,183	12,373	176	18,732	15,260	2,584
1944	6,461	19,739	190	26,390	26,750	2,823
1945	6,119	33,161	408	39,688	41,102	3,671
1946	15,404	59,031	1,431	75,866	76,941	3,903
1946:						
Apr.	1,113	4,842	124	6,079	6,114	4,190
May	1,268	4,903	107	6,278	6,463	4,373
June	931	4,648	121	5,700	5,710	4,377
July	1,513	4,345	101	5,959	5,702	3,954
Aug.	1,697	5,107	127	6,931	7,032	3,929
Sept.	1,641	4,998	96	6,735	7,287	4,435
Oct.	1,882	6,538	113	8,534	8,087	4,108
Nov.	1,659	5,334	172	7,165	7,643	4,365
Dec.	1,842	6,130	191	8,163	7,550	3,903

Source: The Rubber Manufacturers Association, Inc.
n.a.—Not available.

Smoked Sheets—Spot Closing Prices

(New York Market—Cents per pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1910	288	141	206.60	1929	26⅜	15½	20.55
1911	184	114	141.30	1930	16½	7½	11.98
1912	140	108	121.60	1931	8⅝	4¼	6.17
1913	113	59	82.04	1932	4¾	2½	3.49
1914	93	56	65.33	1933	9⅞	2⅞	5.96
1915	79	58½	65.85	1934	15⅞	8¾	12.92
1916	102	55	72.50	1935	13¾	10½	12.37
1917	90	52	72.23	1936	23	13½	16.41
1918	70	40	60.15	1937	26⅞	14	19.39
1919	57	38½	48.70	1938	17⅞	10¼	14.64
1920	56½	16	36.30	1939	24	14¼	17.57
1921	21¾	11½	16.36	1940	24	18¾	20.10
1922	28⅜	13⅜	17.50	1941	24⅞	19⅛	22.40
1923	37⅛	24¾	29.45	1942	22½	22½	22.50
1924	40⅝	17⅛	26.20	1943	22½	22½	22.50
1925	121	34⅜	72.46	1944	22½	22½	22.50
1926	88½	36¾	48.50	1945	22½	22½	22.50
1927	41¾	33	37.72	1946	22½	22½	22.50
1928	41¼	17	22.48				

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1940	1941	1942	1943	1944	1945	1946	1947
Jan.	11.19	10.66	19.85	21.34	20.76	22.36	25.49	32.58
Feb.	11.10	10.87	20.05	21.61	21.34	22.29	26.57	33.91
Mar.	10.90	11.08	20.42	21.98	21.65	22.43	27.52	....
Apr.	10.89	11.48	21.10	22.02	21.71	21.88	28.40	....
May	10.33	12.97	20.88	21.97	21.63	23.30	28.17	....
June	10.72	14.66	19.78	21.92	22.31	23.42	29.89	....
July	10.42	16.55	20.27	21.46	22.33	23.27	34.11	....
Aug.	9.84	17.06	19.45	21.09	22.11	23.10	36.31	....
Sept.	9.69	17.94	19.62	21.10	22.10	23.25	37.59	....
Oct.	9.62	17.31	19.79	21.00	22.32	23.85	36.79	....
Nov.	9.97	17.21	20.21	20.32	22.13	24.71	31.50	....
Dec.	10.18	18.09	20.55	20.32	22.28	25.21	33.03	....
Average for Year	10.40	14.66	20.16	21.34	21.89	23.25	31.28	....

Consumption of Vinyl Resins

(In Thousands of Pounds)

	Sheeting and Film [a]	Textile and Paper Coating Resins [b]	Molding and Extrusion Materials [a]	Adhesives [b]	All Other [c]
1946:					
Jan.	1,569	1,650	5,496	399	352
Feb.	1,666	1,035	5,910	390	589
Mar.	2,161	1,689	6,665	....	1,276
Apr.	2,243	1,436	5,265	....	1,804*
May	2,375	1,397	4,666	....	2,188*
June	1,857	1,235	4,978	....	2,402*
July	2,198	2,134	5,512	....	2,972*
Aug.	2,426	2,910	4,874	....	2,733*
Sept.	1,054	3,103	4,886	....	2,792*
Oct.	1,429	3,069	5,349	....	3,098*
Nov.	893	3,660	5,693	....	3,209*
Dec.	1,828	2,874	6,243	....	3,261*

Source: Bureau of the Census.
Notes: (a) Includes weight of fillers, plasticizers and extenders; (b) Resin content; (c) Excludes data for protective coating resins. * Includes Adhesives.

ERNEST JACOBY & CO.

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Crown Rubber Clay — *Carbon Black*
Rubber Chemicals — *Rubber Colors*

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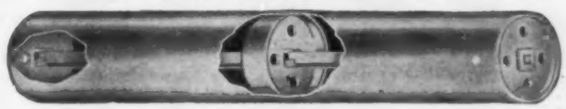

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Rubber Industry Employment, Payrolls, Wages and Hours

Employment — Thousands of Production Workers and Index (1939 = 100)

Month	1945 All Rubber Products Number	1945 All Rubber Products Index	1945 Rubber Tires & Tubes Number	1945 Rubber Tires & Tubes Index	1946 All Rubber Products Number	1946 All Rubber Products Index	1946 Rubber Tires & Tubes Number	1946 Rubber Tires & Tubes Index
Jan.	199	164.9	97	178.5	209	172.7	99	182.4
Feb.	200	165.1	96	178.0	214	177.1	101	187.3
Mar.	209	173.2	96	176.8	220	181.5	104	191.6
Apr.	205	169.6	93	172.2	220*	182.0*	104	192.8
May	201	166.6	92	169.2	221*	182.7*	105	193.4
June	199	164.5	90	166.7	225	186.1	106	195.8
July	194	160.5	88	162.1	218	180.2	99	183.1
Aug.	191	158.0	86	159.3	227*	187.5*	103	189.9
Sept.	165	136.5	72	132.7	233*	192.8*	107*	197.0*
Oct.	187	154.4	88	163.0	240*	198.7*	110	204.0
Nov.	194	160.1	91	168.9	245	202.9	112	207.0
Dec.	203	168.2	96	177.8	247	....	...	....

Payrolls — Production Workers Pay Rolls Unadjusted Index (1939 = 100)

Month	1944 All Rubber Products	1944 Rubber Tires & Tubes	1945 All Rubber Products	1945 Rubber Tires & Tubes	1946 All Rubber Products	1946 Rubber Tires & Tubes
Jan.	291.0	288.9	323.2	342.4	290.1	272.6
Feb.	295.7	295.6	323.6	339.8	292.1	271.9
Mar.	297.0	299.3	315.4	301.9	302.8	281.1
Apr.	281.3	280.0	315.9	306.0	324.9	312.9
May	283.3	283.0	299.8	288.6	327.6	314.2
June	281.4	278.5	304.3	293.8	337.2	318.3
July	279.7	280.9	298.7	286.8	327.2	304.3
Aug.	291.0	294.3	265.7	249.7	343.2	311.2
Sept.	294.5	300.8	231.3	211.4	370.9*	348.9*
Oct.	293.3	297.5	254.2	239.8	368.5	346.1
Nov.	293.6	298.2	257.8	240.2	385.1	363.3
Dec.	308.5	319.4	275.5	256.7	....	....

Wages — Average Weekly Earnings

Month	1944 All Rubber Products	1944 Rubber Tires & Tubes	1945 All Rubber Products	1945 Rubber Tires & Tubes	1946 All Rubber Products	1946 Rubber Tires & Tubes
Jan.	$48.18	$55.79	$54.49	$64.29	$46.71	$50.29
Feb.	48.95	57.21	54.40	64.04	46.05*	49.21*
Mar.	49.53	58.38	50.62	57.29	46.46*	49.72
Apr.	48.12	55.63	51.93	59.75	49.67*	54.77*
May	48.98	57.11	50.09	57.32	49.82	54.72
June	49.30	56.78	51.45	59.20	50.45	54.82*
July	49.17	57.01	51.81	59.59	50.60	56.11
Aug.	50.24	58.62	46.76	52.81	51.03*	55.42*
Sept.	50.99	59.33	47.20	53.59	53.69*	59.89*
Oct.	50.92	58.54	45.57	49.48	51.74	57.38
Nov.	50.59	58.30	44.68	47.78	52.98	58.87
Dec.	52.64	61.62	45.48	48.54	....	....

Wages — Average Hourly Earnings

Month	1944 All Rubber Products	1944 Rubber Tires & Tubes	1945 All Rubber Products	1945 Rubber Tires & Tubes	1946 All Rubber Products	1946 Rubber Tires & Tubes
Jan.	$1.066	$1.224	$1.151	$1.317	$1.121	$1.255
Feb.	1.072	1.240	1.149	1.314	1.129	1.266
Mar.	1.086	1.256	1.117	1.260	1.138	1.275
Apr.	1.075	1.234	1.136	1.294	1.232*	1.414*
May	1.087	1.257	1.132	1.284	1.266	1.446
June	1.092	1.254	1.140	1.307	1.283*	1.461*
July	1.094	1.256	1.138	1.296	1.292	1.472
Aug.	1.102	1.264	1.119	1.269	1.295*	1.474*
Sept.	1.117	1.273	1.098	1.243	1.323*	1.507*
Oct.	1.108	1.263	1.100	1.231	1.313	1.492
Nov.	1.107	1.258	1.112	1.249	1.322	1.503
Dec.	1.130	1.290	1.113	1.247	....	....

Hours — Average Weekly Hours per Worker

Month	1944	1945	1946	Month	1944	1945	1946
January	45.2	47.3	41.7	July	45.0	45.5	39.2
February	45.7	47.3	40.8*	August	45.6	41.8	39.4
March	45.6	45.3	40.8*	September	45.7	43.0	40.6
April	44.7	45.7	40.3	October	45.9	41.4	39.4
May	45.1	44.2	39.4	November	45.7	40.2	40.1
June	45.2	45.2	39.3	December	46.6	40.9	...

Source: U. S. Department of Commerce. * Revised.

Indexes of Production, Shipments and Inventory For The Rubber Industry

Production 1935-1939 = 100 (Based on man-hours)

Month	1944	1945	1946	Month	1944	1945	1946
Jan.	242	247	215	July	227	218	211
Feb.	244	247	216*	Aug.	231	193	221*
Mar.	242	236	221*	Sept.	230	172	234*
Apr.	231	233	219*	Oct.	231	191	234*
May	230	224	215*	Nov.	231	192	243
June	228	222	218	Dec.	239	205	245

Shipments—Average Month 1939 = 100 (Based on $ Value)

Jan.	274	311	229	July	295	274	268
Feb.	299	351	242	Aug.	288	255	282
Mar.	290	351	260	Sept.	297	200	311
Apr.	295	356	282	Oct.	342	260	...
May	293	333	288	Nov.	293	212	...
June	316	333	293	Dec.	341	292	...

Inventory — Average Month 1939 = 100 (Based on $ Value)

Jan.	179.6	170.6	173.7	July	174.7	183.3	195.0
Feb.	185.2	176.7	179.9	Aug.	172.9	182.4	198.0
Mar.	187.6	175.5	186.4	Sept.	174.3	177.4	204.0
Apr.	190.6	175.3	198.5	Oct.	174.3	167.7	....
May	188.1	178.3	195.5	Nov.	176.1	167.1	....
June	182.1	178.7	192.4	Dec.	169.6	169.0	....

Source: U. S. Department of Commerce. * Revised.

Various Compounding Materials Consumed by the Rubber Industry

Material	1939	1940	1941	1942	1943	1944	1945
Asphalt [a]							
Short tons	24,293	23,772	20,536	22,263	16,510	20,189	19,483
% of total	1.0	0.9	0.6	0.6	0.5	0.6	0.5
Barite (barytes):							
Short tons	3,319	4,283	9,800	6,334	8,000	10,000	10,000
% of total	2.0	2.3	4.2	3.6	3.9	2.9	2.1
Carbon Black:							
Short tons	158,311	155,090	219,751	147,974	236,737	369,015	402,193
% of total	56.5	58.5	68.2	65.8	75.2	78.7	78.9
Clay, Kaolin:							
Short tons	90,287	92,640	127,055	51,334	50,964	59,588	109,936
% of total	11.6	11.1	11.6	5.1	5.5	6.8	11.7
Clay, Fire & Stoneware:							
Short tons	3,770	10,104	9,000	5,000	10,259	7,160	7,800
% of total	0.2	0.4	0.2	0.1	0.2	0.1	0.1
Lead Sulfate, Basic:							
Short tons	140	128	200	89	131	268	200
% of total	2.5	2.1	1.9	1.1	2.3	4.2	5.2
Lime:							
Short tons	1,357	1,879	3,058	1,381	2,039	5,634	7,170
% of total	0.03	0.03	0.05	0.02	0.05	0.13	0.10
Litharge:							
Short tons	1,404	1,590	3,968	3,460	4,302	3,023	1,864
% of total	1.6	1.8	3.3	3.8	3.8	2.2	1.3
Lithopone:							
Short tons	3,189	3,387	3,547	1,047	1,078	726	977
% of total	2.2	2.2	2.0	0.8	0.8	0.5	0.7
Mica, Ground:							
Short tons	2,539	1,731	3,476	1,754	3,063	1,137	3,715
% of total	8.2	6.2	8.0	3.7	6.0	2.2	7.0
Sulfur:							
Short tons	49,000	54,000	63,000	40,000	51,000	63,000	64,960
% of total	2.5	2.5	2.4	1.4	1.8	1.9	2.0
Talc [b]							
Short tons	31,078	28,501	58,114	40,487	48,994	51,833	62,049
% of total	12.4	10.0	13.9	10.0	11.8	13.0	15.0
Zinc Oxide:							
Short tons	70,187	70,979	90,429	52,717	67,898	59,518	63,447
% of total	61.3	62.8	63.4	53.0	47.4	42.3	49.6

Source: U. S. Bureau of Mines.

Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes pyrophyllite and ground soapstone.

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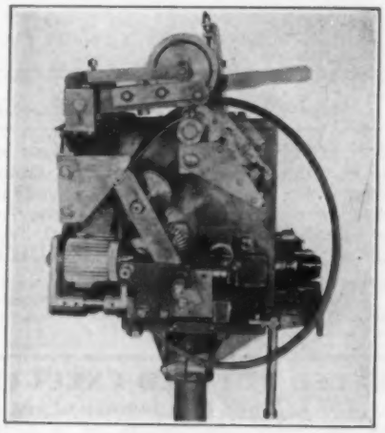

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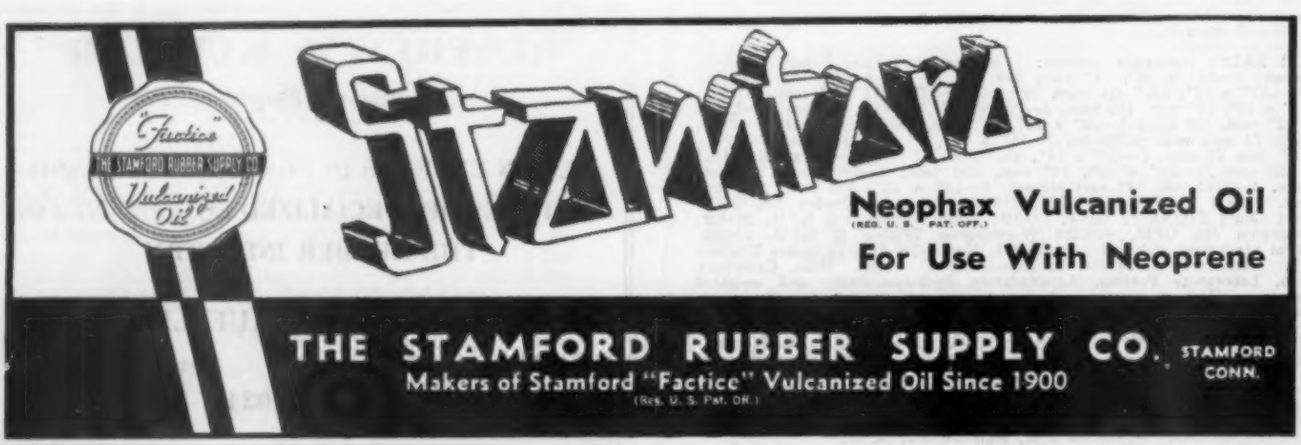

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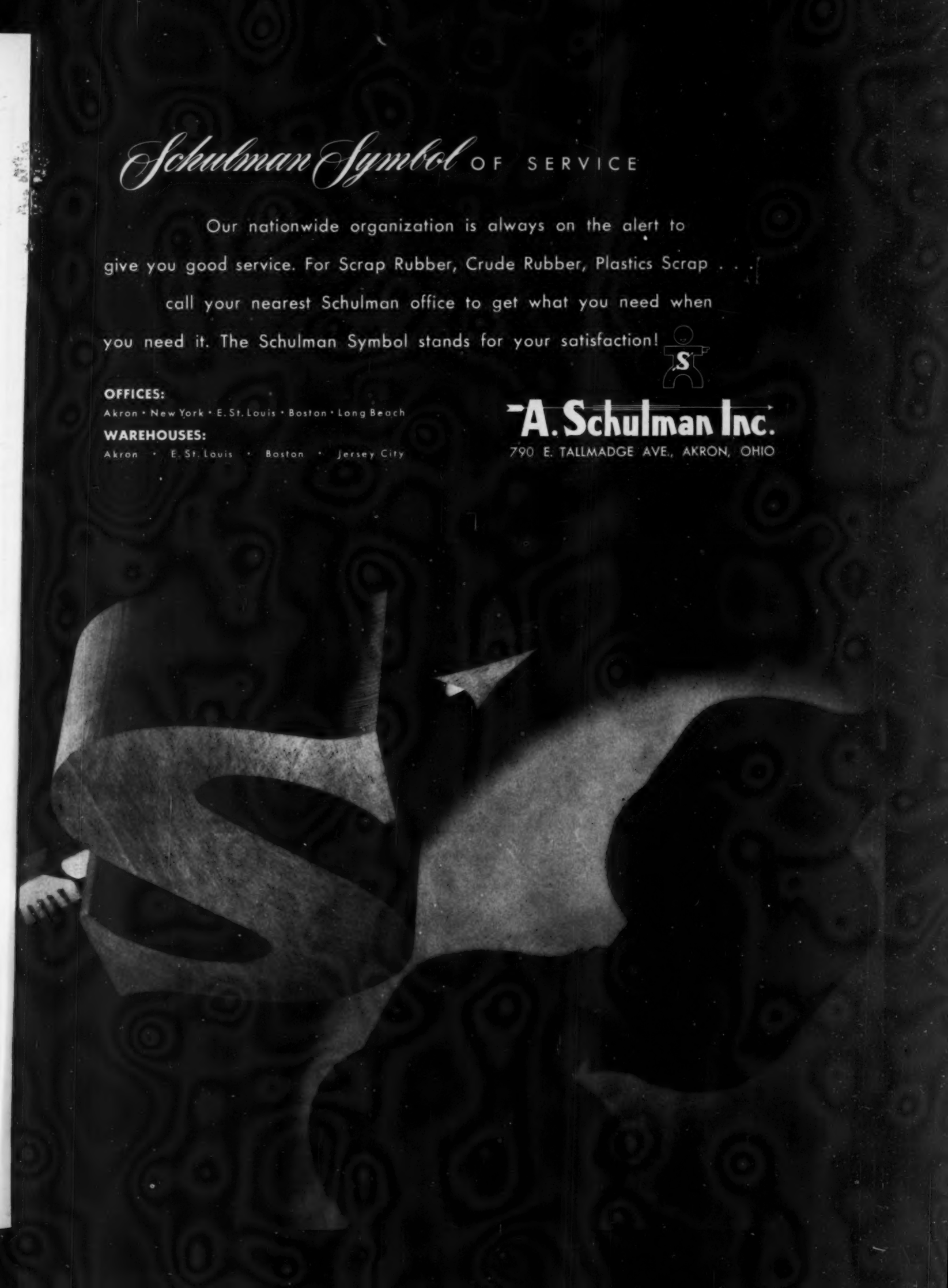

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